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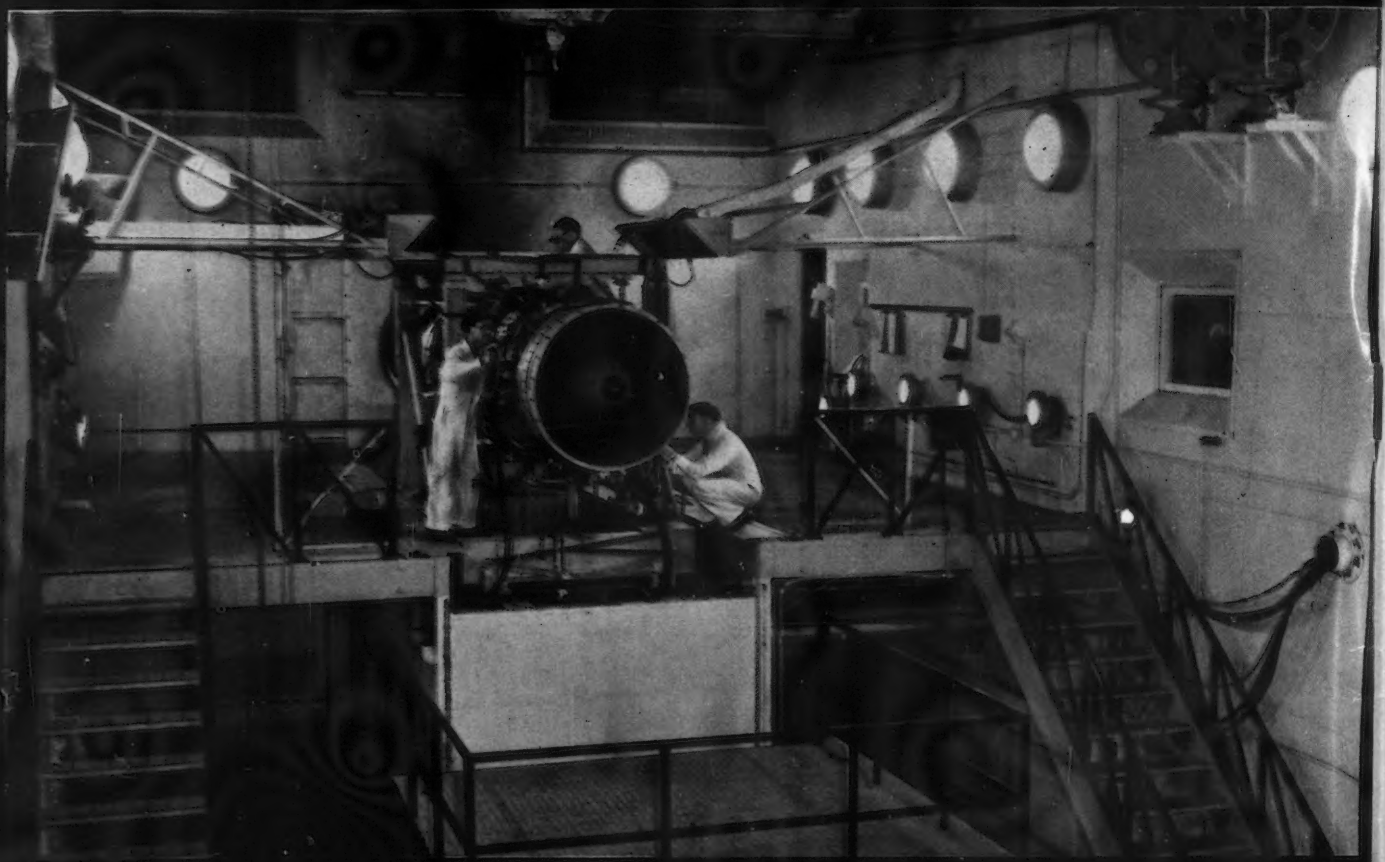

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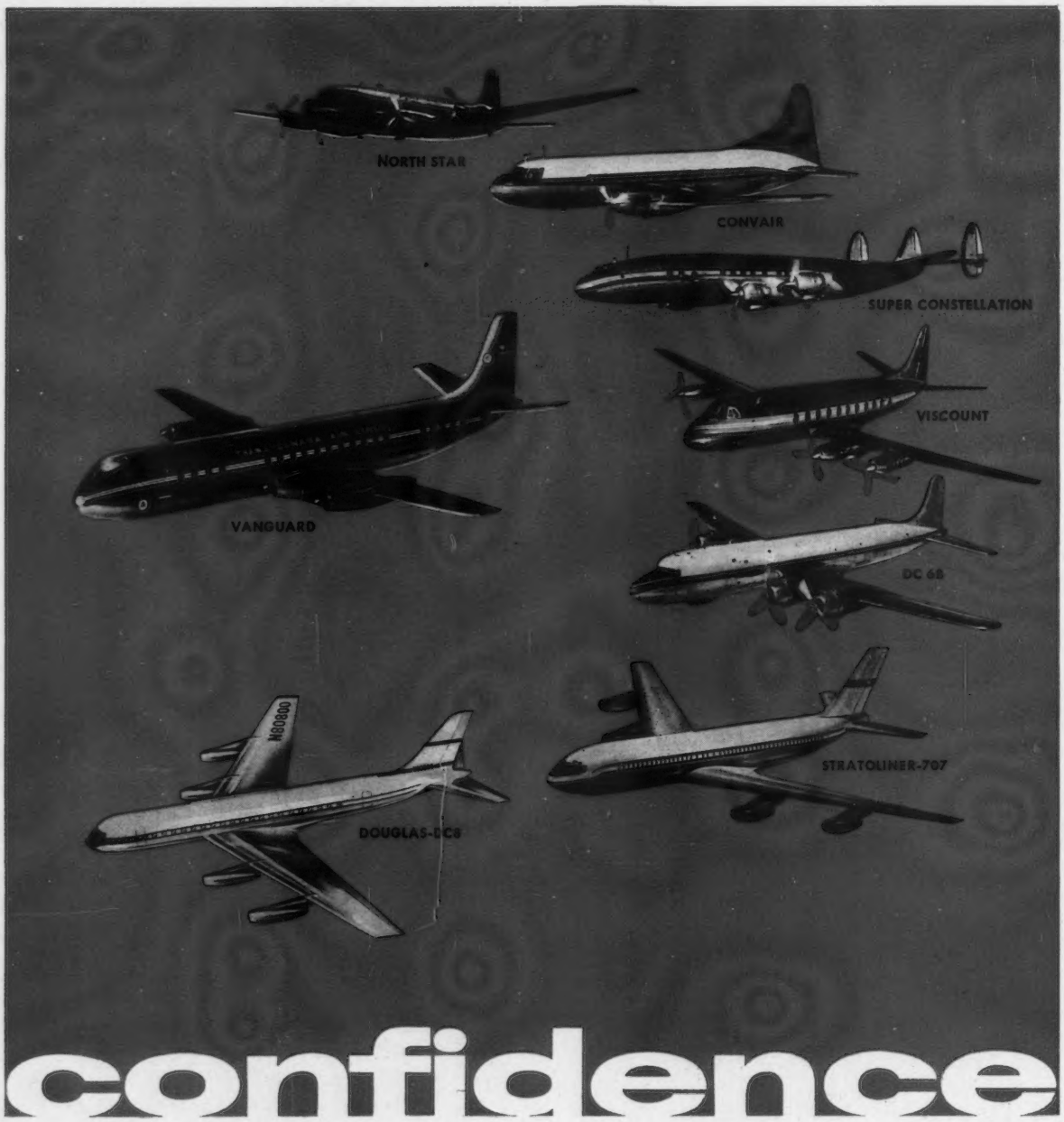

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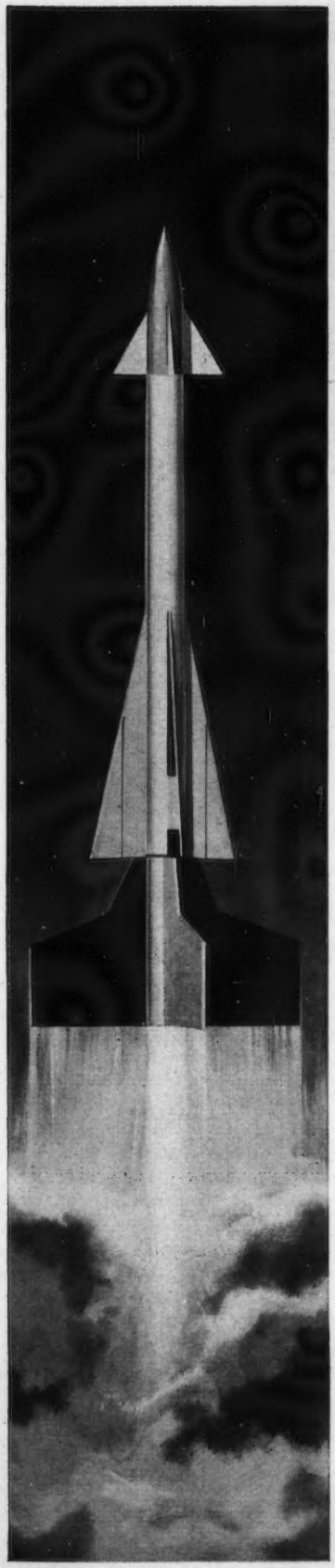

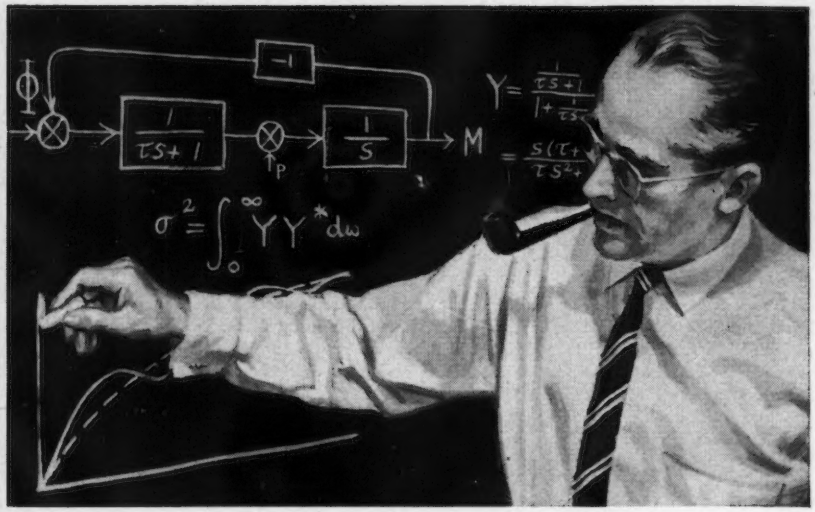

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THE PRESIDENT 1958-59

Gordon N. Patterson

EDITORIAL

THE PRESIDENT'S MESSAGE

We are beginning a year of activities in the Canadian Aeronautical Institute which has a special significance. February 23, 1959, is the 50th anniversary of the first flight of a powered aeroplane in Canada. 50 years ago from that date, John A. D. McCurdy piloted the Silver Dart half a mile over the frozen surface of Bras d'Or Lake at Baddeck, N.S. This flight is symbolic of the fact that the part played by Canada in aeronautical development dates back to the earliest days of powered flight.

Active participation of Canada in aeronautical science began with the work of Wallace Rupert Turnbull, which dates from his association with Langley and Lilienthal in 1900. Turnbull built the first wind tunnel in Canada at Rothesay, N.B., in 1902 and used it successfully to investigate longitudinal stability and the design of propellers. Systematic experiments in aircraft design were made possible by the formation at Baddeck in 1907 of the Aerial Experiment Association, the Silver Dart being one of the four manned aircraft developed by this organization. The chairman of this group was the well-known scientist, Alexander Graham Bell, who had previously carried out many investigations into the possibility of manned flight. Other members were John A. D. McCurdy and Frederick W. (Casey) Baldwin, both engineering graduates of the University of Toronto, Glenn H. Curtiss of Hammondsport, N.Y., whose knowledge of engines was invaluable to the group, and Lieutenant Thomas Selfridge of the United States Army, who participated in a number of the flight trials. After some preliminary trials with a manned kite over Bras d'Or Lake in 1907, the Association's activities were transferred to a workshop at Hammondsport, owned by Curtiss. In 1915 the Curtiss Company of Hammondsport established a branch plant in Toronto for the manufacture of aircraft. It was characteristic of Canada's early aeronautical history that it should involve a close cooperation with the United States.

In 1918 the University of Toronto became a centre of aeronautical research under the supervision of John H. Parkin with the construction of a 4′ x 4′ wind tunnel of a type developed by the National Physical Laboratory in England. By 1927 the need for instruction in aeronautical engineering was recognized, and in 1928 a course was initiated at the University of Toronto. The present undergraduate course was pioneered largely by Professor T. R. Loudon. The Canadian government became active in aeronautical research and development in 1928, when approval was obtained for the establishment of aeronautical research facilities by the National Research Council. We see that in about 20 years following the flight of the Silver Dart, aeronautical education, research and manufacture had been established in Canada.

There are many other "firsts" in Canada's aeronautical history which might also be mentioned, but perhaps sufficient has been stated to show that traditionally Canada has played a significant role in the development of aeronautics from the very earliest days of powered flight. Our present day maturity is evidenced by the growth and scope of the Canadian Aeronautical Institute, founded in 1954.

The 50th anniversary of an historical event is a time for looking into the far future, but scientific progress is presently accelerating at such a rate that this is extremely difficult. Nevertheless, it is interesting to examine the timetable of future events proposed by James B. Edson, Assistant to the Director of Research and Development of the Department of the United States Army (*Bulletin of the Atomic Scientists*, March, 1958) which may be summarized as follows:

1958-1962	Launching of unmanned vehicles around the moon and back to the vicinity of the earth; solution of the re-entry problem and recovery of satellites; progress in readying man biologically for space flight.
1963-1967	Launching of highly developed satellites with payloads of 5,000 - 10,000 lb; permanent manned satellite stations.
1968-1973	First manned landing on the moon; establishment of permanent lunar bases; first Martian landing.

Whether one agrees with this timetable or not, it is evi-

dent that in the next 50 years the world will witness a phenomenal expansion from aeronautics to astronautics.

What will be Canada's part in these developments? Retirement to the sidelines is not consistent with our aeronautical history. The technical capacity to make a contribution exists in Canada now. The greatest need at the moment is some form of guidance on what projects might be undertaken by existing laboratories. Perhaps a National Committee for Space Technology should be set up to advise engineers and scientists in Canada of the areas where research and development might be attempted. It may be possible for such a committee to promote a more active cooperation in space technology with other countries.

These are questions of serious concern to the members of the Canadian Aeronautical Institute. The CAI was formed at a very appropriate time in Canada's aeronautical history. Matters of aeronautical-astronautical policy should receive detailed discussion within its organization and recommendations should be forwarded to responsible authorities. Let us see to it that Canada continues to make a significant contribution.

DR. G. N. PATTERSON
President 1958-59

ASTRONAUTICS SECTION

MEETING

9th October, 1958

at 9.30 a.m.

R.C.A.F. Officers' Mess,
Gloucester Street,
Ottawa, Ont.

Admission restricted
to members of the
C.A.I.

The programme will start with a short business session at which the new Executive Committee will be installed and the future activities of the Section discussed. This will be followed by three papers, reviewing the state of the art in their respective fields.

The Clock Paradox – W. F. Campbell, National Research Council

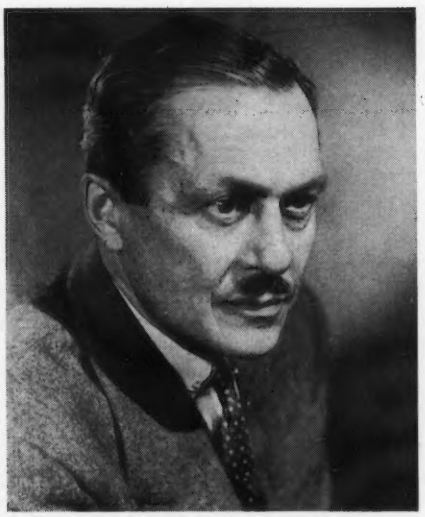
Propulsion Systems for Space Travel – Dr. H. S. Ribner, Institute of Aerophysics, University of Toronto

Guidance and Control – R. D. Richmond and D. Bogdanoff, Canadair Ltd.

THE ROLE OF SCIENCE IN DEFENCE†

by Dr. A. H. Zimmerman*

Defence Research Board



Dr. A. H. Zimmerman

It is a great pleasure for me to be here tonight and to have this opportunity of speaking to you.

Tonight I speak to you as an engineer, with some experience in both industry and government. In my present capacity my days are spent largely with scientists, and of course the defence research program for which I am responsible is primarily related to fundamental and applied science rather than to engineering development.

THE QUEST FOR SURVIVAL

My general theme tonight is "The Role of Science in Defence", with special emphasis on its application to aeronautical engineering. I think we might all agree that the technological advances of the 20th Century have far outstripped all of those made in all past history. In the early stages of man's history, his chief preoccupation was to procure sufficient food, shelter and clothing for survival. For these essentials to life, he depended almost wholly on his own physical strength and ingenuity for success. In the sophisticated civilization in which we now live we are still faced with the problem of survival, primarily because man has now mastered such enormous powers of destruction as to make no place on earth safe from attack.

The wheel seems to have gone full circle, with vast technological changes but with little if any progress towards a solution of the original problem — that of ultimate survival.

The outpouring of new knowledge, in all fields of science, is now such that no man, or group of men, can hope to understand more than a small fraction of it, and the pace continues to accelerate. As one writer has put it, many people are asking "How long will it last? Will this rate of material progress continue faster and faster? Will it level off — or will it end in the catastrophe of a war that will annihilate civilization as we know it, ending in a return to the Dark Ages?"

These are the fundamental questions today and certainly there are no pat answers.

Under all the circumstances, our national course has been, and indeed continues to be, to promote international peace by every available means, but at the same time to recognize that it is only prudent to keep our guard up. It is the leaders of governments and statesmen who must take the responsibility for promoting peace, for discovering new and sure ways by which man can learn to live at peace with his neighbour, but it is the scientists and engineers who are entrusted with providing protection to ensure survival meanwhile.

So, until peace is declared and can be accepted with confidence on all sides, it would seem that we must continue to press on with technological advances at as rapid a rate as we can afford, and in a direction which is calculated to defeat foreseeable threats.

These are my major points: that the *rate* of advance must continue to be rapid, and that the *direction* of our effort — in other words, our research and engineering programs — must be sufficiently flexible to prepare for defence against a variety of threats. I refer particularly to threats from manned bombers, from ICBM's and from submarine-launched missiles.

We are becoming more aware every day of Russia's intense drive and concentration on scientific achievement. From early school age to graduate level, science is encouraged by real incentives. Bright students by applying themselves to their academic training are rewarded with a higher standard of living than their fellows; teachers are held in high respect and paid very

†Dinner Address delivered at the Annual General Meeting of the C.A.I. on the 26th May, 1958, in Toronto.
*Chairman.

well; first class buildings and equipment are provided on a lavish scale; it is in fact quite clear that an aristocracy of privileged people, largely made up of scientists and engineers, is emerging.

One writer has summed it up by saying that "Russia's national preoccupation is in solving scientific and intellectual problems and indeed to wrest technological superiority away from the West". Another goes even further. He says, "It is not only our military, scientific and technological capabilities that Russia has challenged. In a more subtle and profound way it is challenging our system of government. Can Democracy ensure survival?"

Such statements as these only serve to strengthen our determination in the West to keep pace, otherwise we will surely lose the race.

FACTORS OF PROGRESS

In considering what is a practical rate of advance from the scientific point of view, there would seem to be three basic factors, without any one of which further progress would eventually be slowed almost to a halt. I am going to talk about these factors for they are, I think, particularly relevant to the aircraft industry at the dawn of the Atomic Space Age.

They are – the growth of new knowledge, the availability of new sources of power, and the development of new materials.

New knowledge

It is self-evident that the discovery of new knowledge, of new facts hitherto unknown or of new natural laws, must, in the main, stem from basic or fundamental research, carried out largely at universities or at government research laboratories. The scientist is not concerned with the profit motive. He carries out his researches and his experiments purely in the hope of adding something new to man's store of knowledge of the world about him and of the natural laws which apply to it. Frequently the true scientist does not even know where his work is leading him; often he does not even care, so long as he is adding to knowledge of his subject. But he persists, and from time to time he achieves a "breakthrough" which he thereupon hands over to any one who wants to use it. His discoveries and achievements provide the raw material for the engineer. His end point is the engineer's starting point.

The engineer, on the other hand, *must* be concerned with the profit motive. It is up to him to take the raw material of the scientist and put it to practical use, in a form, and at a price, that makes it both attractive and useful to a customer. This is true whether the product is one which can be sold to the public-at-large by the million, or whether it is extremely costly, such as a complex weapons system, with but a single customer – the government. My point is that the engineer and the scientist must work together as a team. If the rate of advance I mentioned a few minutes ago is to continue, they must communicate continuously with one another for, in fact, they are mutually dependent.

New sources of power

The second factor essential to rapid advance lies in the need to make available new sources of power, again a problem for scientists to discover and for engineers to put to use.

We have seen in Canada the successive discovery and development of power from several sources – from the early use of the water wheel located on the banks of fast-flowing rivers to drive the crude machinery of the early saw mills, flour mills and textile plants; to the use of steam power derived from coal; to the giant hydro-electric plants of today, and to the many uses of oil as a prime source of power.

If I may digress for a moment, my mention of giant hydro-electric plants reminds me of the new St. Lawrence Power and Seaway Development. Between Iroquois and Cornwall the face of nature is being changed on a grand scale, including a tremendous dam at Iroquois to control the level of Lake Ontario and an International Power Plant at Cornwall designed to generate 1,640,000 kw by 1960. In the process, some 20,000 acres of land will be flooded necessitating the removal of several entire villages to relocate 6,500 people on high ground in newly-built communities. Long stretches of main highways and rail lines must be moved – even cemeteries cannot be left to the flood. This project is a modern saga of the historic St. Lawrence Valley on a scale unlikely to occur again in our lifetime. If you have not already done so, I can strongly recommend a visit to the site, from which I am sure you and your children will return with a sense of pride in this great Canadian achievement.

Beyond the sources of power I have mentioned, we have the promise of nuclear power, both by fission and by fusion, now in its infancy.

As applied to defence problems, we already have nuclear propulsion available for ships, which may well change and extend the strategic role of the Navy.

Last December, I was privileged to go for a short cruise in the USS Sea Wolf, the second nuclear-powered submarine built for the US Navy. The relative simplicity and reliability, coupled with high speed, of this new source of power was most impressive. In the reactor room, lined with instrument panels, control buttons, switches, meters, gauges and flashing lights, there was a brass plate mounted on the head of the reactor itself which read:

"Property of U.S. Government – DO NOT OPERATE BEFORE READING INSTRUCTIONS"

This did seem like a slight over-simplification.

Some day the problem of weight and safety may be solved to the point of making nuclear power practical for flight in one form or another.

In the meantime, a great research effort is going into the so-called "exotic" fuels, to provide efficient power for supersonic and possibly hypersonic flight in outer space, in the form of either liquid or solid propellants.

Again in the Space Age, man's ability to fly ever higher and faster is dependent on the availability of new sources of power.

New materials

The third factor we must consider is the need for new materials. Having mastered the sonic barrier – although there is still much to be learned about that strange phenomenon – we face the thermal barrier,

which as you all know is the speed of flight at which high temperatures affect airframe skins and structures adversely. In addition, there is the great problem of finding new materials which will withstand and contain the hot gases produced by the new sources of power.

Many research attacks are being made on these problems, including experiments on a wide variety of surface coatings on what might be called conventional metals; on new alloys using rare metals and on various combinations of metals with ceramic materials. Satisfactory answers are essential if the engineer is to further widen the horizon of space flight.

In summary then, we find that the scientist must be encouraged to continue in his role of contributing to the growth of new knowledge, discovering new sources of power, and inventing new materials.

TIMING AND COORDINATION

The engineer, however, has several equally important responsibilities – one is to identify and interpret his own needs to the scientist, in order to stimulate research in useful directions; another is to exercise creative imagination in putting scientific discoveries to use. Since he cannot do everything, he must be *selective* in his projects, and here a correct evaluation of the time factor is of supreme importance.

From a defence standpoint, considering the very long lead time required for development, production and deployment of a complex weapons system – usually from 7 to 10 years or even more – there is little merit in spending the national wealth on a project which matures too late, or is obviously obsolescent in the face of probable enemy threats.

Let me explain for a moment what I mean when I refer to a "complex weapons system".

It is natural that you in the aircraft industry, spending most of your waking hours thinking of aeroplanes, may think of an interceptor fighter by itself as being a weapon for defence against an attack by manned bombers. It is, in fact, only one part of an extremely complex weapons system which, to be at all effective, must include such vital elements as the ground radar early warning and detection system – 3,000 miles of it across the Far North, the Mid-Canada Line radar chain, the ground environment for control and data-processing necessary to place the fighter in a position to intercept the enemy; all of the essential split-second communication links between these lines; the integrated electronic fire control, navigation and communications equipment installed within the aircraft, and finally the guided missile with which the aeroplane is equipped.

It takes little imagination to see why it takes so many years for a weapons system to be researched, developed and built, and it is easy to understand why still later research and development may cast a long shadow of obsolescence ahead of it.

In short, the problem of long lead time has never been more crucial. Expensive projects become fruitless if they cannot be carried out rapidly.

In one of our applied research labs there hangs a sign which reads, "*If it works, it's obsolete*". While, hopefully, that isn't often true at the applied research stage, it tends to become progressively more true as further years of development and production mount up.

This points up the need for maintaining a continuous momentum of research even though the later use of it may not carry through to production.

Perhaps the solution is to design the research and development program in such a way that successive projects will overlap in time, but not necessarily implying that they will all be carried through to production. Such a system would, however, keep our knowledge up to date and would enable us to produce a given type of weapons system in perhaps half the time required if we wait for complete production of one before beginning on another.

AERONAUTICAL RESEARCH IN CANADA

Now I would like to say a few words about the status of aeronautical research in Canada, with respect to its application to defence problems.

As Canadians, we can take considerable pride in the fact that, since 1945, some 25 types of aircraft have been produced in Canada, almost half of them of native design. But we cannot feel so happy about research for which our resources are relatively meagre. There are reasons for this situation. The results of research and design in the US and UK have been available to us, and we have been able to use many of the facilities in the US for model testing and applied research generally.

We in the Defence Research Board have recognized that this is not a healthy, balanced condition for the future and we are doing something about it in several directions.

The keystone of any continuing research program is a supply of competent scientists and engineers for the research establishments and industry. To this end, the DRB grants approximately $300,000 per annum to the various universities to provide facilities and support research projects for training in the Aerodynamics and Gas Dynamics fields. Similarly, in the Structures and Materials field, DRB grants to universities are of the order of $130,000 per annum.

As many of you know, there is now a well-established Institute of Aerophysics for post-graduate training and research at the University of Toronto. This is physically located at Downsview and has been largely financed by DRB. Similarly, a smaller laboratory has been established at Laval University in Quebec, also financed by DRB, in order to encourage another centre for the training of aerodynamicists. In the propulsion field, DRB has supported a Gas Dynamics Laboratory at McGill University in Montreal for several years.

Early this year the Government gave its approval to construct a $6,000,000 wind tunnel at Ottawa. This is being jointly financed by DRB and NRC and, it is hoped, will be ready for operation by 1960. This tunnel, with a 5-ft-square test section, will have a speed range from zero to Mach 4.5, resulting in Reynolds Numbers up to 15 million per foot, which represents a tenfold improvement over our present supersonic testing capabilities. This tunnel will have sufficient flexibility to test models of any type of airborne vehicle, whether manned aircraft or unmanned missile, and even certain types of propulsion systems, such as ramjets.

And at our Canadian Armament Research and Development Establishment in Quebec we have an 800-ft aeroballistic range in which models can be tested and photographed in free flight up to hypersonic speeds. As an adjunct to the CARDE activities, we also maintain a fully instrumented free flight range at Picton, Ont., where much of the dynamic stability testing on the CF-105 aircraft was carried out.

Perhaps one of the most revolutionary advances to be made in aviation will be the achievement of true vertical takeoff and landing, which has now become practicable with the advent of lightweight gas turbine powerplants. Recognizing this potential, the DRB has sponsored a number of research contracts with the Canadian aircraft industry in both the STOL and VTOL regimes and the associated propulsion systems. You will hear preliminary reports on the results of some of these activities in your technical sessions tomorrow morning.

These are some of the measures we have taken to encourage careers in solving problems in the evolution of flight, and to provide much-needed research facilities in Canada.

INTO THE FUTURE

In conclusion, I have attempted to indicate very briefly something of the role of Science in Defence, which hinges largely on the relation of the scientist to the engineer.

The world now stands on the threshold of the Space Age. Perhaps it could be more simply called the Scientific Age. In very recent years we have seen spectacular development in the speed of flight, in the power of the atom, and in the myriad uses of electronics. The future staggers the imagination.

> In 1948, Professor Einstein is reported as saying this: "Our situation is not comparable to anything in the past. It is impossible therefore to apply methods and measures which at an earlier age might have been sufficient. We must revolutionize our thinking and revolutionize our actions."

Yes, we sense many new and as yet unknown developments ahead, even though we cannot yet fully understand their implications.

In today's exploding technology it is surely the scientist and the engineer who will lead the way.

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AIRLINE PLANNED MAINTENANCE†

by R. J. McWilliams*

Canadian Pacific Airlines, Ltd.

SUMMARY

The attempt is made to show how one company has evolved a system for controlling its flying and maintenance operations to achieve greater economy of its resources. Additionally it is hoped to show how this economy may be further improved by more attention to those details which have adverse effect on maintenance costs.

The paper deals with the subject in three steps; outlining the objectives; describing the systems and procedures developed to meet the objectives; and closing with a discussion of the major problem areas, including some suggestions for the improvement of planning functions.

INTRODUCTION

SOMEWHAT to our embarrassment, we were quoted extensively in a magazine article published not long ago. To make matters worse, the one quote that we thought worthwhile was omitted. The quote in question is:

"an aircraft is the most useless thing on earth."

This might well be the theme for this paper.

OBJECTIVES

The objectives have been well defined on many occasions and are generally accepted throughout the industry.

The relationship of revenue and costs makes it imperative that the maintenance cycle match the operational cycle. It must also be sufficiently flexible to meet unforeseeable operational requirements.

The reliability of the aircraft must be improved by a maximum of preventative maintenance and a minimum of over-inspection.

Planning and control are considered inseparable and the objectives in our field may be summed up as follows:

(a) The application of modern methods and production control principles to aircraft maintenance.

(b) Detailed planning of functional checks, inspections, replacements, repairs etc., to ensure a maximum economy of manpower and the shortest turn-around time.

(c) A study of the requirements of maintenance from the point of view of aircraft and component design, and the elimination of unnecessary processes.

(d) Logical control of Inspection Schedules and the periodicity of inspections.

(e) Analysis of work delays, to reduce turn-around time.

(f) Statistical study of manpower requirements to permit sound calculation of personnel establishments.

(g) Continual development of tools and equipment to reduce man-hours and fatigue.

(h) The application of a fool proof system of reporting, recording and statistical analysis.

(i) Planned spares requirements. Under the planned maintenance system, spares requirements are related to flying intensity and the total number of units in use.

CPAL PLANNED MAINTENANCE SYSTEM

The question can now be asked, "What action have we taken to pursue these objectives?"

Scheduled Services

The maintenance workload is based on the amount of flying required of an aircraft, or a fleet of aircraft. The primary factors to be considered are, what flying is required by Sales and Traffic, and what are the foreseeable changes to the flying plan.

Flying intensity, or utilization, is based on scheduled services and the number of aircraft to accomplish them. Any increase in flying intensity will produce a proportional increase in economic employment of existing manpower, equipment and facilities. Flying intensity may be increased by reducing flight schedule time and decreased by delays en route.

The above factors can be affected to a large degree by:

(a) Phasing the maintenance checks to the flying schedule to give the maximum utilization of aircraft.

(b) Planning maintenance procedure.

(c) Improving the quality of maintenance work.

(d) Ensuring reliable and efficient preventative maintenance.

(e) Repair by replacement.

Progressive inspection

The system of progressive inspection is ideally suited to CPAL overseas schedules, due to the route pattern and to the flying times involved. Vancouver, the major maintenance base, is at the centre of a radial route pattern (see Figure 1).

Progressive inspection breaks down the minor/major inspection system and regroups the items into a system whereby the aircraft is progressively maintained throughout its life. The aircraft is maintained under a system of continuous airworthiness, by a series of Checks carried out at base only.

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†Paper read at the Mid-season Meeting of the C.A.I. in Vancouver on the 28th February, 1958.

*Superintendent of Planning.

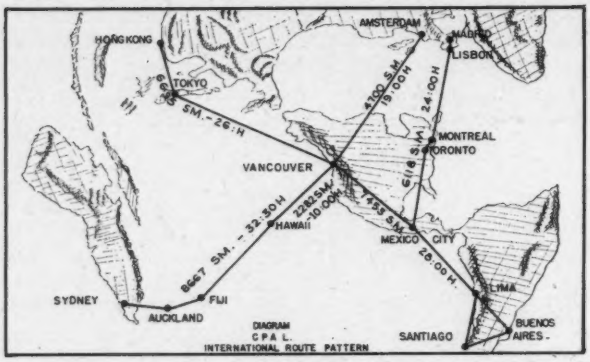

Figure 1
CPAL route pattern

Major advantages of such a system are:

(a) A balanced maintenance work load is attainable.
(b) To achieve quick turn-around between operational cycles Checks are completed in minimum time at base only.
(c) To ensure regular and reliable operation, the maximum preventative maintenance must be resorted to at base, e.g. by replacing components during a Check to avoid failure en route.
(d) The Check cycle is closely related to the operational cycle.

Progressive inspection system

The various Checks used are as follows:

(a) *Service Checks*
  (i) En route Check — A simple check at each en route station, cutting itemized work to an absolute minimum. Cleanliness and attention to passenger service requirements the main items. Elapsed time one hour.
  (ii) No. 1 Check — Accomplishment of itemized work, plus rectifications, using base facilities between scheduled trips. Elapsed time six hours.

(b) *Progressive Checks*
  (i) Equalized Checks — Itemized work in the minor periodicity range, so arranged that each Check is equal in man-hours. Elapsed time 16 hours.
  (ii) Progressive Overhaul Checks — Itemized work in the major periodicity range, component replacement for overhaul, and aircraft modifications. Elapsed time 10 days.

Check schedule

The Inspection Schedule is identified for each of the Equalized Checks and Progressive Overhaul Checks. For each type of Check, the Schedule lists in proper sequence all items of work to be completed. Similarly, for each Check the Schedule is divided into aircraft areas or Zones, as follows:

Zone 1 No. 1 Powerplant
  No. 2 Powerplant
  No. 3 Powerplant
  No. 4 Powerplant
Zone 2 Flight compartment
Zone 3 Fuselage interior
Zone 4 Fuselage exterior (including nose wheel well, baggage, hydraulic and heater compartments)
Zone 5 Wings (including nacelles and main wheel wells)
Zone 6 Empennage (interior and exterior)

Each Zone is further sub-divided into the various basic trades as follows:

Inspection
Maintenance
Instruments
Electrical
Radio
Cleaner

See Figure 2 for sample page of Check Schedule.

Work cards

The detail of each work item is listed in logical sequence on work cards for the individual tradesmen involved in the Check (Figure 3). To enlarge upon the sample shown, it is necessary only to add the following. The first digit of the work card number identifies the Zone involved; the second digit, the trade involved; the third and fourth digits identify the work item. In addition to the standard method to complete the work, the card also contains information concerning tools, equipment, materials, fits and tolerances etc. (It should

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PERIOD	PROGRESSIVE O/H CHECKS D & H	PART NO.	CARD NO.
	FLIGHT DECK - RADIO (Cont'd)		
3000	Receiver Auxilliary - RC-34&Q	R4&401	2338,2342
3000	Amplifier Flight Interphone MI-32A	R4701	2328,2331
3000	Radio Relay - A.D.F. Transfer	R49961	2366
3000	Radio Relay - V.H.F. Co-Axial 14&60-3	R4&901	2356
3000	Radio Relay - Cross Pointer Ind. Transfer	R4998&	2367
3000	Accessory Unit 351A - V.H.F.	R41951	2357,2387
3000	Cabin Press Amplifier A/C 431-438	R4967	
3000	Cabin Press Amplifier A/C 439-444	R4961	
6000	Pacitor Power Unit	R42001	2369,2371
6000	Amplifier IA-17A - Service Interphone	R5301	2327,2333
6000	Coupler - Loran CU-92	CU-92	2352
	FUSELAGE INTERIOR - INSPECTION		
500	Fuselage Inberior - Inspection		3000-1-2
1500	Structure Check - Aileron Cross Compt.		3026
	FUSELAGE INTERIOR - MAINTENANCE		
100	Water Filter - Replacement - A/C 437-444	DA1&2	3120
300	Toilet Seat - Removal		3100
300	Toilet Seat - Installation		3105
300	Centre Aisle Carpet - Installation		3114
500	Lubrication - Fuselage Interior		3109
1500	Duct - Cabin Thermister - Check		3108
1500	Passenger Seats - Removal		3124

Figure 2
Sample page CPAL inspection schedule

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DOUGLAS DC-6-B - MTCE. OPER.

A/C No. ..... Date ... / ... / ..... Pos.: 1 2 3 4 Left ☐ ☐ Right Fore ☐ ☐ Aft

NO.		Initial
	PARTS REQUIRED: REGULATOR - R 48581 - KOLLSMAN 29606-23 (A-C 431-434 ONLY) CONTROLLER - R 13713 - KOLLSMAN 2215 @ -B-21 (A-C 437-444 ONLY) HOSES - 4278, 4271 (A-C 431-434 ONLY) HOSE - 4278 (A-C 437-444 ONLY)	
1.	LOOSEN CABIN B-C CONTROL PANEL FASTENERS.	
2.	MOVE PANEL SLIGHTLY OUTWARD AND DISCONNECT ELECTRICAL CONNECTOR.	
3.	DISCONNECT THE AIR HOSE (S) AT THE REGULATOR.	
4.	REMOVE FOUR MOUNTING SCREWS AND REMOVE THE REGULATOR.	
5.	REMOVE THE AIR HOSE(S).	
6.	OBTAIN SPARE CABIN PRESSURE REGULATOR, CHECK FOR EVIDENCE OF EXTERNAL DAMAGE.	
7.	TRANSFER TAG TO REMOVED HOSE AND REGULATOR.	
8.	INSTALL NEW HOSE(S) AND CONNECT TO PLUMBING.	
9.	INSTALL REGULATOR AND SECURE WITH FOUR MOUNTING SCREWS.	
10.	CONNECT THE HOSE(S) TO THE REGULATOR, ALSO THE ELECTRICAL CONNECTOR.	
11.	INSPECTOR'S O.K. TO CLOSE PANEL.....	
12.	REPLACE B-C CONTROL PANEL ENSURING THAT HOSES BEHIND PANEL ARE NOT KINKED.	

TIME, est. act. UNIT, off on.

1249 | FLIGHT DECK - CABIN PRESSURE REGULATOR - REPLACEMENT | | | ELECTRICAL

Figure 3
Sample work card

be noted that emphasis is placed upon what to do, not how to do it.) At the bottom of the card is printed the time scale — 1 inch = 1 hour. Every effort is made to limit the work on each card to a maximum of 2 hours. The reverse side of the card is used by the tradesman to record the time the job is started and completed, and provides him with the facility to describe any delays or difficulties experienced.

Check planning

Checks are planned in detail. The objectives of this planning are:

(a) To ensure systematic and thorough inspection.
(b) To improve reliability and regularity of aircraft.
(c) To complete the Check in the shortest possible time.
(d) To reduce the expenditure of manpower to a minimum.

In achieving these objectives the following are avoided:

(a) Congestion in restricted parts of the aircraft, e.g. cockpit.
(b) Unnecessary repetition of work, e.g. access panel removal.
(c) Interference between tradesmen working in different zones.
(d) Unnecessary movement of tradesmen unable to do their work in logical sequence.
(e) Some tradesmen lagging behind others.
(f) Inability of any one person to review the progress of the Check as a whole.
(g) Failure to record defects discovered during a Check.
(h) The illogical deferment of work.

Check control

To permit the logical planning of known work and to ensure advance warning of the effect of unplanned additional work upon the Check Schedule, the Sched-U-Graph form of load control is used. The boards are made up by the maintenance planners, using the area loading technique described above, and provisions are made to facilitate the in-Check planning of additional work by the Check controller. Referring to Figure 4, it will be seen that the board is divided into the Zones or areas described above. Sufficient slides are assigned to each Zone to accommodate the various trades and men engaged in the work. Trade names are used at the left margin of the board.

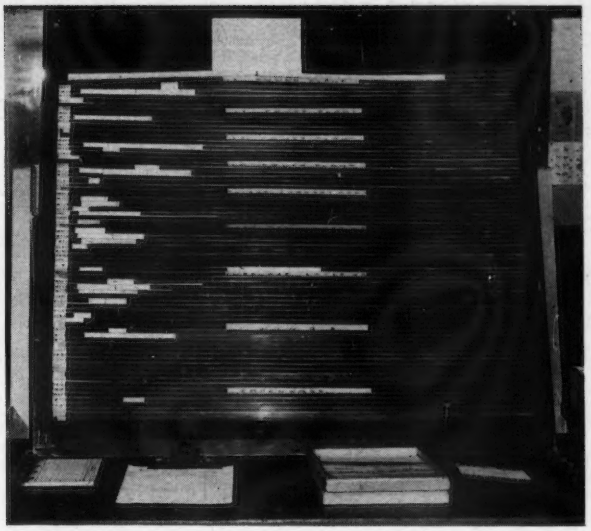


Figure 4
Sched-U-Graph board for equalized check mounted on mobile control desk

At the top of the board is located the base time scale, which is the same as that used with each work card. When inserting each work card, the maintenance planner marks the planning standard for the job on the card time scale. Upon inserting the next card in the sequence, he does so in a manner to expose the appropriate length of the time scale of the previous card. Pendant from the top of the board is the plumb line which is moved along the base time scale as the shift progresses.

As the Check progresses, additional work items are discovered and are written up on additional work cards. These can be inserted appropriately by the Check controller, making use of the spaces provided by the maintenance planner. This can be done intelligently and logically since the whole Check is displayed and the Check controller has before him a complete work picture, interior and exterior, of the aircraft.

A mobile control desk is used with the Equalized Checks (Figure 4). For the Progressive Overhaul Check, the aircraft is placed in a semi-mobile Work Dock (Figure 5) and the Sched-U-Graph board is used in the

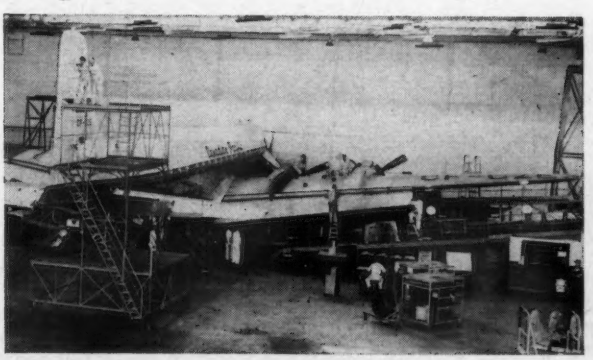


Figure 5
DC-6B work dock

Figure 6
Sched-U-Graph board for progressive overhaul check mounted in work dock control office

control office, which is an integral part of the starboard wing platform (Figure 6).

It will be appreciated that the Sched-U-Graph board permits the logical assessment of manpower requirements at any time during a Check. Progressive Check personnel (crews) are established for a normal load of work arising from regular flight operations, as determined from the Check Schedules, plus an allowance for normal rectification. Additional work is accomplished by Check personnel during slack periods or, when this is inadequate to meet the deadline, additional manpower is drawn from the servicing crews or from the appropriate overhaul shops.

Repair by replacement

Adequate supplies of replacement components can be provided at a fraction of the cost involved in providing regularity of operation by reserve aircraft.

The principle of repair by replacement is a fundamental requirement of any system of workload forecasting and scheduling, its main advantages being:

(a) The interruption of flight schedules is reduced to a minimum and the utilization of aircraft can be greatly increased.
(b) The reconditioning of the removed component can be done systematically with adequate tools and facilities, after the aircraft has departed.
(c) Component overhaul and rectification can be planned to a smooth flow of work.

Quality control

Our systems of planned maintenance and progressive inspection are backed by a team of methods analysts, who, together with the inspection team, form the Quality Control department.

The functions of the methods analysts may be summed up as follows:

(a) The detailed investigation and analysis of corrective maintenance items, with a view to improving servicing and maintenance procedures.
(b) The investigation and analysis of aircraft systems and components reliability to:
  (i) improve functional checks and component overhaul procedures, and
  (ii) improve component overhaul periods.

Inspectors are assigned on a regular basis to Progressive Overhaul Checks only. On occasion they are called upon by the servicing crews for special inspections or in cases where duplicate signatures are required. Sampling methods are being developed to measure the quality of servicing work.

ACHIEVEMENTS

To obtain support for future plans, it is necessary at times to put aside modesty, however becoming, and speak of what has been achieved. The lack of statistics, of which we shall hear more later, does not permit us to support a formal claim for a number of achievements. Fortunately, we are not entirely fact-less. We can support a claim for some advance in four main areas, as follows:

(a) Under the old system of minor/major Checks for the DC-6B aircraft, excluding down time for major overhaul at 12,000 hrs, each aircraft was out of service for a total of 283 elapsed days during the overhaul cycle. Under the new system of planned maintenance, each aircraft will be out of service for 192 days during the cycle. Total flying days saved per aircraft – 91, i.e. 24 additional days per aircraft per year (Figure 7).
(b) Under the old system, our DC-6B utilization (again, not including down time for major overhaul) was 8.5 to 9.0 hrs per aircraft per day. We are currently achieving 10.5 to 11.0 hrs per aircraft per day – a 25% increase in utilization, i.e. a saving of two aircraft based on present fleet size (Figure 8).
(c) In October, 1954, four DC-6B aircraft totalled 1,100 flying hours, with a direct labour staff count at the Vancouver base of 327. In October, 1957, ten DC-6B aircraft totalled 2,700 flying hours with a direct labour staff count at the Vancouver base of 501, indicating a 145% increase in flying with a 53% increase in manpower (Figure 9).
(d) In 1954, with four DC-6B aircraft, the average monthly defect rate was 174/1,000 hrs. In 1957, with ten DC-6B aircraft, with a 25% increase in utilization, the average monthly defect rate was 176/1,000 hrs (Figure 9).

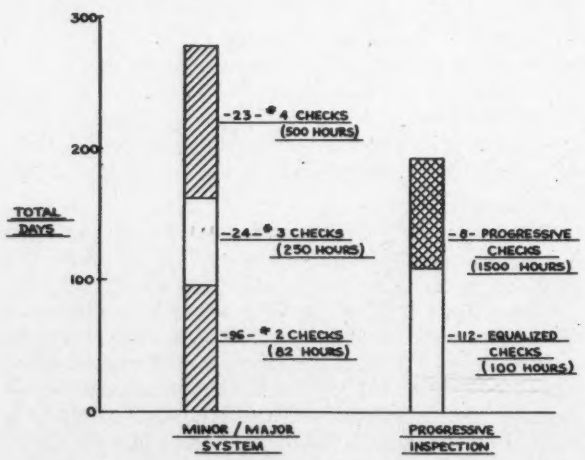


Figure 7
Chart of maintenance elapsed days, DC-6B aircraft during 12,000 hr cycle. Minor/major system versus planned maintenance system.

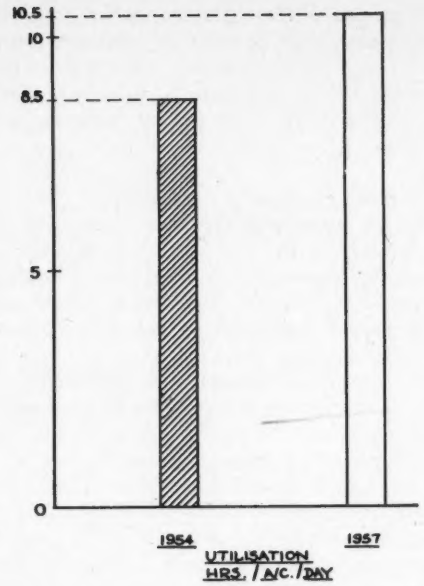


Figure 8
Chart of DC-6B aircraft utilization. Minor/major system versus planned maintenance system

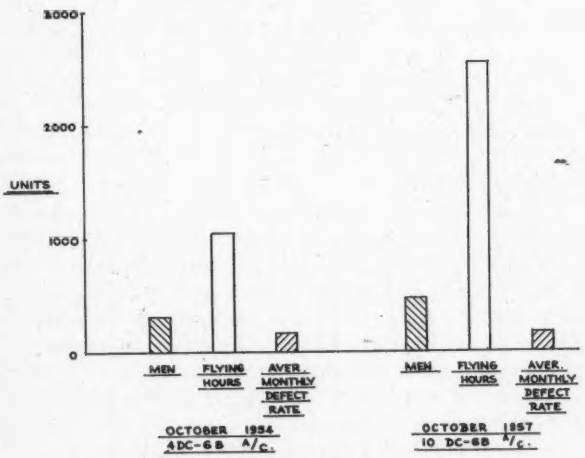


Figure 9
Chart of man-hours versus flying hours and quality

THE FUTURE

It is appropriate now to ask another question, a more pertinent one perhaps – "How far are we along the road toward achieving our ultimate objectives?"

In the first place, I do not think that any of us in this wonderful business of ours will ever achieve the ultimate. And, in the second place, I must confess that there is hardly an area in which we have achieved our aim. Apparently, we are still marching along the road, on all fronts.

We can, however, achieve the last objective set for this paper by reviewing briefly several main problem areas confronting us at the present time.

Operations planning

Our product is the flying hour and aircraft maintenance is one of the major prices which we have to pay. Planned maintenance involves the future commitment of men and materials and the full implication of this planning may not be felt for some considerable time. Decisions made now have a lasting effect and too often we overlook some of the ramifications.

It is not the purpose of this review to analyze the problems of the Sales, Traffic and Operations departments; however, it is essential that we be aware of and appreciative of them. Our detailed planning must be developed to the second twelve month hence. To do this adequately and efficiently, we must be in on the first (and subsequent) crystal gazing sessions.

The problems of flight schedules and aircraft routing and rotation are affected by many factors, the primary ones from the planning point of view being:

(i) Route pattern – stage lengths, cruise speeds, time zones, interconnecting flights.
(ii) Sales bookings – load factors, multi-class accommodation.
(iii) Equipment maintenance – aircraft hours, Check schedule, major unit change schedule.

Aircraft routing is a function of the Planning Department and is the personal responsibility of the supervisor of the maintenance planning section. The requirements of the planned maintenance system are met, against the background of the flight schedules, through the use of an aircraft rotational plan developed on a wallboard (4′ × 8′). The upper half of the board is shown in Figure 10. The board displays two months of operation and is shortly to be enlarged to display three months. The left margin lists the aircraft numbers of the particular fleet. Above the main display is shown the day and date for each appropriate month. In each of the plastic slides is scheduled, on a basis of elapsed time, the various trips (white slips) and the various types of Checks (coloured slips) appropriate to a particular aircraft. Superimposed upon the Check slips are the major unit exchange requirements. The routing is reviewed weekly and from the rotational plan is developed a weekly routing chart which shows in considerably greater detail the servicing and maintenance work load for each day of the week.

For use in Schedules Committee meetings, much the same type of plan is used, the major difference being that the left margin lists the various trips or scheduled flights, adjacent to which are scheduled the particular aircraft planned to accomplish each trip (again on the basis of elapsed time). This plan is produced in chart form, legal size.

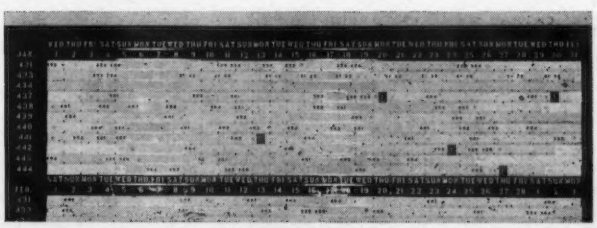


Figure 10
DC-6B aircraft rotational planning board

It will be appreciated that this empirical approach to optimisation is tedious, time-consuming and inefficient. We are hopeful that this problem will submit to the analytical approach through the use of some form of electronic processing. Our experience to date in this respect has not been very encouraging and will give an interesting insight into modern "computery". We discussed the problem with the experts of a well-known firm who went away with all applicable information. In due course of time, we were advised that they were unable to find a solution and that, to their knowledge, nobody has yet been able to find a mathematical solution to the problem with so many restrictions! Nevertheless, we remain hopeful.

Work scheduling

With the exception of fuel costs, maintenance costs are the largest single contributing factor to operating costs. Major cost savings can be achieved by close attention to production planning and control procedures.

It has been said that good planning can be achieved without scheduling, but that good scheduling cannot be achieved without good planning. Work scheduling is the control phase of planning. Scheduling is work control and work control is cost control!

Work scheduling cannot be properly applied without reliable labour standards, which brings us to the heart of this problem.

A review of the history and experience of various industries and of various airlines reveals that there are three phases to be passed through in the development of labour standards:

(i) educated guesses by responsible people on the job concerning the work content of a given job,
(ii) job analysis and time estimating by competent, independent observers working closely with first line supervision, and
(iii) the application of time and motion studies and other related industrial engineering functions.

Much as one might wish to benefit by the experience of others and leap to more advanced plateaux, it would appear to be an immutable law of nature that procedures develop steadily but slowly. Unfortunately, in a progressive and expanding industry, such as ours, it is not uncommon to find the work load growing at a greater pace. Consequently, although we may not be able to take big leaps, it is imperative that we make use of the latest techniques of work measurement to achieve optimum results with a minimum of effort. The most promising development of recent years is the work sampling technique – the quantitative analysis by sampling methods of the activity of men and machines.

Industrial engineering

Industrial engineering has been described as the mechanics of management and its major purpose the reduction of costs. The application of industrial engineering techniques, such as methods analysis, work measurement and simplification, and production control, to the peculiar problems of air transportation can be particularly rewarding. That these functions are generally accepted goes without saying. However, it is contended that there is a great need for improvement in the development of these techniques for use in our particular industry. The practice of drawing experienced personnel from line departments, admirable and essential though it may be, is not enough; it must be backed by formal education and training in the industrial engineering function.

Cost accounting

A primary function of cost accounting is the analysis of costs to assist in the cost control programme. Under a system of planned maintenance, cost accounting can help to create the additional function of directing the efforts of production planning and control in order to attack high cost areas.

To perform this additional function adequately, it is necessary that costs be accumulated in a manner which lends emphasis to:

(i) controllable groups of men, and
(ii) controllable types of work.

It has been our experience that this is somewhat foreign to normal accounting procedure.

In accepting the foregoing, it is necessary to recognize the inadequacies of the existing CAB and ATB classification of accounts. It is necessary also to recognize the somewhat different requirements of financial accounting and production costing.

A properly established cost accounting system can be of immeasurable benefit to the planner. It can provide the essential statistics for the creation of reliable labour and material standards, and materially assist the vital function of work scheduling. Last, but by no means least, it can help provide the statistics necessary for us to prove that a new procedure is, in fact, worthwhile.

Spares provisioning

With conventional transport aircraft, it is generally accepted that maintenance costs can be fairly equally divided between labour costs and material costs. It has been variously reported that with pure jet aircraft this ratio will be from 1 - 3 to 1 - 4, with no decrease in total labour content! Our preliminary estimates for turboprop aircraft indicate something mid-way between conventional and jet aircraft, closer to the latter than the former. It is evident that we must pay closer attention to material planning and control in the future.

Our experience would indicate a major problem area with rotable spares, viz generator, cabin supercharger, control surface and propeller. This is a two-fold problem of capital cost and expense. Any improvement in provisioning procedures will result in a very satisfactory reduction of both first cost and operating costs.

We have attempted, with some success, the application of the analytical approach towards the calculation of rotable spares requirements. The requirements are based on two major considerations:

(i) Insurance requirements – To minimize costly delays en route, certain components and parts are stocked at en route stations. Major factors for consideration are:
  (a) which major components are essential for the continuance of a flight, and
  (b) what is the probability of an off-scheduled removal arising?

(ii) Maintenance requirements – Bearing in mind the principle of repair by replacement, major factors are:
   (a) equipment utilization – considering accumulated unit operating hours in a given period, coupled with a measurement of component reliability, and
   (b) plant facilities – considering the factors of manpower, methods, equipment and spare parts supply.

Our list of major components required at outside stations for the continuance of a flight is continually under review with our Operations department. Considerable savings can be made and thousands of dollars of investment capital put to better use by calculating the probability of the requirements and assessing analytically the risk involved. With present techniques, i.e. those known to the writer, it is possible only to do this based upon the expectation developed from past experience. This is considered a much too costly method. Bearing in mind the multiplicity of outside bases for an international route pattern, it is patently evident that such heavy capital expenditure can only be properly justified by utilization. Maximum utilization is best achieved by centralization; in our case at the Vancouver base. The time must come, with the advent of turboprop and jet aircraft, when the shipment of rotables to and from an outside base must take top priority, even to the extent of bumping a passenger.

In addition to the foregoing, the aircraft manufacturer can provide invaluable assistance in being specific in his "Go, No-Go List". The operator needs to know specifically the items of equipment necessary for the continuance of a flight, not generalities referring to whole systems.

With a considerable background of unit removal data and with the use of statistical analysis, we have developed simple formulae for the calculation of spares to meet the requirements of the planned maintenance system.

Two major factors emerge from this experience – the vital effect of:

(i) the forecast of flight operations; a minimum of twelve months required in order to develop realistic unit operating hours, and
(ii) the process time for the overhaul or repair of units; lending emphasis to the need of work scheduling and improved handling methods.

We still have much to learn, particularly in the application of statistical tools. In the matter of component performance and reliability, the methods known to the writer place undue emphasis upon these units which failed and too little upon the potentiality of those units which went to "time expiry".

The problem of initial spares provisioning is entirely different. Several major factors are unknown and it will be one to two years before the operator has gained the necessary experience to evaluate these factors. A partial answer to this lies in closer liaison between aircraft manufacturer and component manufacturer, and further emphasis by both on the need for component development and testing.

CONCLUSION

In preparing the paper, the author was acutely aware of its inadequacy. However, if it serves to stir up interest, to spark the exchange of ideas and the discussion of various techniques, it will have served its purpose. The author will welcome correspondence and questions on the subject.

ACKNOWLEDGMENT

The author wishes to thank the Institute for the opportunity to present these views. The help of Mr. I. A. Gray and Mr. C. E. B. McConachie, in their critical review of the paper and their many helpful suggestions, is very gratefully acknowledged.

Acknowledgment is also due to the author's colleagues for the very vital part they played in the development of the procedures referred to and in the formulation of these ideas.

Grateful thanks go also to those unnamed authors of articles and books who have provided, over the years, a fund of notes and quotes. Also to those other airlines who have provided food for thought and many a basic idea which must surely be reflected in this paper.

INCREASE IN HELICOPTER PAYLOAD THROUGH RUNNING TAKEOFF†

by Dr. G. N. Adams* and H. G. Sevier**

Canadair Limited and
Bristol Aircraft (Western) Limited, respectively

SUMMARY

Because less power is required to take off at a moderate forward speed than to take off vertically, the takeoff weight of a helicopter can be considerably increased in operations which are based at an airfield, provided the helicopter is of a suitable configuration to permit a running takeoff.

The technique is described and the increase in payload-range capability is shown for a particular helicopter.

INTRODUCTION

In assessing the capabilities of a helicopter it is usually assumed that a vertical takeoff is required. However, sometimes (as in supplying troops or radar stations, construction sites etc.) the requirement is to carry supplies from an airfield, where they have been brought by air or surface transport, to outposts where fixed-wing aircraft cannot land. In such a situation the helicopter's disposable load can be considerably increased by making use of the airfield for a running takeoff. By the time the destination has been reached, sufficient fuel will have been used to permit hovering, or at least vertical descent at a moderate rate of sink, the kinetic energy of the rotors being used to smooth the landing as in autorotation. After discharging its cargo, the helicopter can make a normal vertical takeoff for the return to base.

It is conceivable that the type of takeoff to be described could be made with a single-main-rotor type helicopter, but it would be very difficult to maintain fuselage attitude using cyclic control alone. To investigate the order of takeoff performance that can be expected, a tandem-rotor helicopter powered by two free-turbine engines and having a four-wheel landing gear has been assumed. The normal takeoff weight may be determined by requiring that the helicopter be able to hover on one engine, using a short-period emergency rating. The gearboxes may then be designed to cope with sufficient power from both engines to give a reasonable vertical rate of climb at this weight. For this investigation the power available at the rotors has been taken as 1,560 hp in the single-engine case and 1,780 hp with two engines. With rotors of about 49 ft diameter the normal takeoff weight is then 17,200 lb. (ISA sea-level conditions with no wind are assumed throughout.) For a contemporary design the weight less payload and fuel, but including crew of two, radio etc., would be about 10,300 lb, leaving 6,900 lb for payload plus fuel.

†Received 25th March, 1958.

*Senior Engineer.

**Aerodynamics Engineer.

RUNNING TAKEOFF

The minimum-power condition is approached at about 60 kts. If the same criterion as before is applied, i.e. ability to maintain height on one engine, the takeoff weight can be increased to 21,500 lb if the helicopter accelerates to 60 kts before leaving the ground. With both engines operating the rate of climb at this speed is 400 ft/min.

For maximum acceleration it is obviously necessary to tilt the rotors forward as far as possible. This means raising the tail so that the helicopter rolls along the ground on its front wheels. This is not so alarming as might at first be thought. The nose-down inclination of 10° on which the calculations are based is comparable to that in high-speed flight, and is also typical of the attitudes assumed in ordinary acceleration. The high pitching inertia of the tandem-rotor helicopter together with the powerful control by collective pitch will minimize any difficulties in maintaining the desired attitude. Likewise, the yawing control should be more than adequate for maintaining heading.

Maximum rotor tilt is obtained by applying full forward cyclic control. The tilt is equal to the sum of the fuselage inclination, the built-in inclination of the hub axis relative to the fuselage, and the applied tilt of the control axis, less the angle of back-flap which varies with speed. With the front rotor hub about 12.7 ft above the ground and allowing for coning, the front rotor blade tips clear the ground by 5.4 ft initially, increasing to 7.4 ft at 60 kts. These correspond to tolerances on fuselage inclination of 14° and 19° before the rotor blades strike the ground.

TAKEOFF DISTANCE

The forces acting on the helicopter are shown in Figure 1. The rotor thrusts are resolved into horizontal and vertical components F_F, G_F, F_R and G_R. The rolling resistance is μ times the vertical reaction R at the front

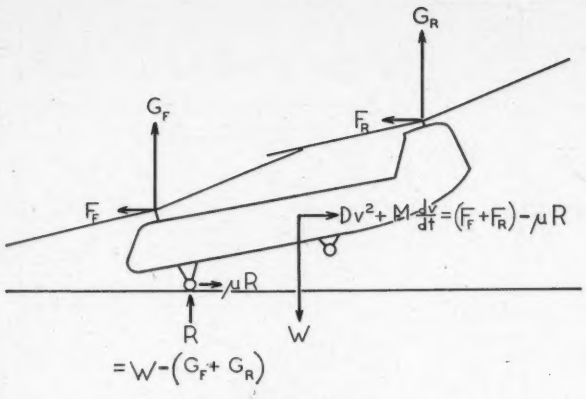


Figure 1
Forces on the helicopter during a running takeoff

wheels, and the weight W, drag Dv^2, and inertia force Mdv/dt are assumed to act at one point. For the specified attitude to be maintained, all forces must be in equilibrium. At a given speed and collective pitch setting the rotor forces are known. Thus by successive trials it is possible to find the collective pitch setting for which the helicopter is in equilibrium, as a function of speed.

Since the helicopter is pivoting about the front wheels which are well forward, it is essentially the rear rotor thrust that is determined by the equilibrium equation. Evidently, the greater the front rotor thrust the greater is the total thrust and, therefore, the forward acceleration. Unfortunately the mixing between cyclic and collective controls, essential for pitching control on a tandem-rotor helicopter, reduces the front rotor collective pitch when full forward cyclic control is applied. It would be possible to increase the total thrust usable by reducing the amount of cyclic tilt, but the forward component would be reduced. Part of the collective pitch differential can be cancelled out by means of the trim control or "stick positioner", and it is assumed that this is done.

There are two factors which help to increase the total thrust. The front rotor is closer to the ground than the rear one and thus benefits from a greater thrust augmentation due to ground effect at low speeds. At higher speeds, the rear rotor encounters air deflected downwards by the front rotor and for a given thrust the collective pitch must be increased, which increases the thrust from the front rotor and, therefore, the total.

The acceleration is given by

$$\frac{dv}{dt} = \frac{(F_F + F_R) - \mu R - Dv^2}{M}$$

The reciprocal of this, i.e. dt/dv, can be plotted against velocity v and integrated graphically to obtain the relationship between velocity and time. From the integration of vdt, the distance covered while accelerating to 60 kts is 705 ft. The helicopter will cover another 760 ft while climbing at 400 ft/min and 60 kts to clear a 50 ft obstacle, making a total of 1,465 ft.

It might be thought that by reducing the weight slightly the takeoff run would be decreased. In actual fact, the thrust must be reduced to keep the tail from rising and the ground run is slightly increased, though the distance to clear a 50 ft obstacle is reduced because of the higher rate of climb. If the weight is reduced to 20,000 lb, the helicopter can rise vertically a few feet above the ground, accelerate to around 15 kts in the ground cushion, and climb away as forward speed is gained. However, it would be desirable to have a runway below in case of an engine failure before the speed of 40 kts necessary to maintain height on one engine is attained.

PILOTING TECHNIQUE

The procedure for a running takeoff would be roughly as follows. The trim would be set full aft and the cyclic stick pushed full forward. With brakes off, collective pitch would be increased until the tail came up to the desired height. This might be gauged by a horizon-sighting device or a gyro-horizon. Alternatively, a pendulum-type device could be used, which would give constant acceleration rather than constant fuselage attitude. It might even be satisfactory simply to maintain constant rotor clearance.

As speed increased and the rear rotor began to be influenced by the front one, it would be necessary to increase collective pitch progressively to maintain tail height. As the takeoff speed of 60 kts was approached, the cyclic stick would be brought back smoothly, collective pitch being increased simultaneously to keep the tail up. The helicopter would soon leave the ground, collective pitch would be increased for climb, and flight would thereafter be normal, except for a somewhat restricted flight envelope.

In the event of an engine failure the helicopter would return to base, if possible, on emergency rating and make a run-on landing. Otherwise it could make a semi-autorotative landing elsewhere. In many cases it would be possible to jettison fuel or cargo while flying on emergency power until the weight was reduced sufficiently to permit a return to base on continuous rating. From structural and space considerations, it would probably be necessary to carry some of the fuel and/or cargo externally and this would be readily jettisonable.

The question of control sensitivity during the takeoff run has been considered. It appears that a given movement of the collective pitch lever would produce roughly the same response of the helicopter's tail during a running takeoff as of the whole helicopter during hovering at normal weight; this should not, therefore, present any problem once the pilot got used to the idea of controlling attitude with collective instead of cyclic. Directional control would be with the yaw pedals, so the cyclic stick would be kept stationary during the takeoff run, though it might be displaced laterally to help counter a cross-wind.

INCREASE IN PAYLOAD

The weight excluding payload and fuel has been taken as 10,500 lb, allowing for a certain amount of strengthening of landing gear and structure which might

be required for running takeoffs at high weight. The weight of payload plus fuel is then 11,000 lb. This is 51% of gross weight and an increase of 60% on the figure for normal takeoff.

Figure 2 shows a curve of payload versus radius of action for a mission which involves an outward flight with payload, a landing and takeoff at the destination, and a return flight empty without refuelling. An allowance of 100 lb of fuel has been made for each takeoff and the cruising speed is 100 kts. The payload that can be carried with a normal vertical takeoff is indicated by a broken line. Figure 2 also shows the weight at each takeoff and landing. The weights at which the helicopter can hover on two engines and on one are shown by broken lines. For distances of less than 125 miles it is advisable to restrict the payload as shown so that the vertical rate of sink at the destination does not exceed 300 ft/min on two engines, or 1,400 on one. This is similar to the landing weight limitation sometimes encountered on fixed-wing aircraft.

It is seen that with a running takeoff this helicopter could deliver 8,500 lb at distances up to 125 miles, decreasing to 5,000 lb at 300 miles and 1,300 lb at 500 miles.

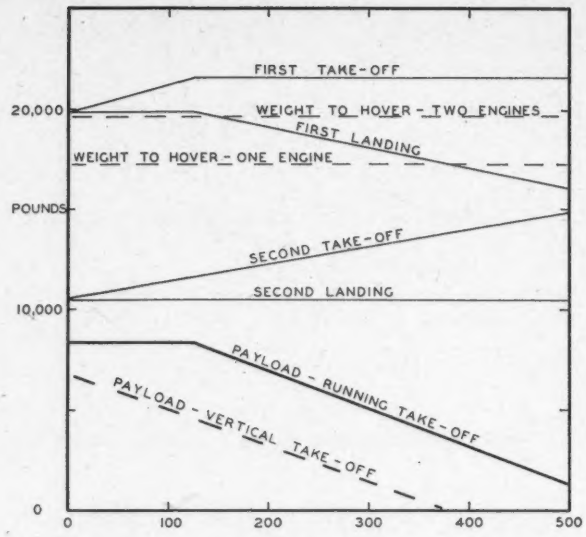


Figure 2
Takeoff and landing weights and payload versus radius of operation

CONCLUSION

The payload-range capability of a helicopter can be greatly increased if a running takeoff can be made.

The authors would be interested to learn if this technique has been tried. Helicopters which might be suitable are the Bell HSL, the Bristol 192 and possibly 173, the Vertol HUP and the Yak-24.

SPECIAL ANNIVERSARY MEETING

QUEEN ELIZABETH HOTEL

MONTREAL

23rd and 24th February, 1959

C.A.I. LOG

SECRETARY'S LETTER

A NEW SEASON

HERE we are in September again, at the beginning of a new season of the Institute's activities. After a two months' rest, the Journal resumes its monthly issues; everything is more or less ready for the joint I.A.S./C.A.I. Meeting early in October; and the Branch programmes for 1958/59 are getting under way. This season will end with the celebration of the 50th Anniversary of flight in Canada and we look forward to a particularly interesting year.

DOWN EAST

During June I visited Baddeck, N.S., and spent a little while there making plans for the memorial that we hope to unveil next summer; I also visited Keltic Lodge, Ingonish, where our next Annual General Meeting will be held, in conjunction with the unveiling ceremony at Baddeck. On my return journey, after a brief stop at Halifax-Dartmouth to report to CDR E. B. Morris, Chairman of our 50th Anniversary Committee, I tried to visit Enamel & Heating Products at Amherst and Mr. D. A. Sanford, Interim Secretary of the Branch that we may establish there some day. My timing was bad and I became involved in the Dominion Day holiday; consequently I was unlucky in Amherst, on both counts.

Towards the end of July I paid a flying visit to Field Aviation, Oshawa, also in connection with the proposed memorial. They may build it for us.

SLIDES

The June issue of the Journal appeared too soon after the Annual General Meeting to enable me to comment on it at that time. But I have a complaint to make and, though that Meeting is now long past, I must voice my complaint for the benefit of future meetings.

The Annual General Meeting was, on the whole, a great success. The standard of the technical papers was unusually high, the rooms were good, the attendance was satisfactory and everything ran smoothly. But one or two excellent papers were spoilt by their slides. No blame can be attached to the projection equipment; sometimes the rooms were not properly darkened; but generally the fault lay in the slides themselves. I received several complaints and one member even wrote to me about it.

The weakness is not confined to our Canadian speakers. Mr. S. Paul Johnston, Director of the I.A.S., writing about the last Anglo-American Conference in England, had some strong words to say about the same thing. I was there and can confirm that his censure was fully justified.

There are a good many booklets and instructions extant on this subject and I should have expected anyone concerned with the making of slides to be familiar with them. Broadly the rules are to avoid predominantly dark pictures, to use black lines on a white background rather than the reverse, and to write large.

A good many slides will be presented to us during the next few months and I hope that, in preparing them, our speakers will remember how much depends on this important detail.

EDUCATION AND TRAINING

I take this opportunity to say a few words about the Institute's activities in the field of education and training; they are often overlooked.

The Council has decided to continue the arrangement we have had in former years, consisting of special Education & Training Committees in British Columbia, Alberta, Manitoba, Ontario, Quebec and Nova Scotia. These Committees keep in touch with local Industry and Educational authorities and their Chairmen meet from time to time to discuss their problems and exchange interprovincial advice. The results are not spectacular but they are quite substantial.

Members who are interested in education and training should refer to the Chairmen of their respective provincial Committees. They are listed on page 3 of the recently issued List of Members.

ANNUAL GENERAL MEETING

THE Institute held its fifth Annual General Meeting in the King Edward Hotel, Toronto, on the 26th and 27th May. In addition to the usual business and technical sessions, the programme included, for the first time, a special session devoted to the presentation of honours and awards and the delivery of the W. Rupert Turnbull Lecture. Formerly honours and awards were presented at the Annual Dinner and the W. Rupert Turnbull Lecture, the premier Lecture of the Institute, was included in the programme of the annual Joint Meeting with the I.A.S. The new arrangement not only enhanced the dignity of the presentation ceremonies and associated the W. Rupert Turnbull Lecture with the other honours conferred by the Institute, but it shortened and simplified the Annual Dinner, giving due prominence to the Principal Speaker.

The Honours and Awards Session took place on the afternoon of the first day and the Dinner followed in the evening. Registration for the technical sessions was 422, and 503 attended the Dinner.

The following is a summary of the proceedings. The Annual Reports and the Address of the Principal Speaker at the Dinner are reproduced in full elsewhere in this issue; a detailed account of the Honours and Awards Session appears on pages 236 to 238. Some of the technical papers presented will also be published in full in later issues of the Journal.

The retiring President, G/C H. R. Foottit, transfers the Chain of Office to the new President, Dr. G. N. Patterson

BUSINESS SESSIONS

Of the Institute

The programme opened on the Monday morning with the annual Business Session, attended by 82 members. G/C H. R. Foottit presided.

After a few words of welcome by Mr. J. W. Ames, Chairman of the Toronto Branch, the Reports of the various Institute Committees were presented by their respective Chairmen. The Secretary read the Reports of the Publications and Specialist Services Committees, in the absence of any members of these Committees. The President then gave a résumé of the Annual Report of the Council and commented upon certain features of the Committees' Reports. All these Reports were duly adopted.

Of the Test Pilots Section

The Annual General Meeting of the Test Pilots Section followed the Institute's Business Session. Mr. D. H. Rogers, Chairman of the Section, presided. He opened the proceedings by reading the Annual Report, reviewing the year's programme and concluding with the hope that more commercial and airline test pilots would join the Section; the present membership of 50 is drawn very largely from pilots engaged on military programmes. The Chairman's Report was followed by the Financial Statement and the Reports of the three Committees of the Section. After some general discussion and the introduction of the new Executive, the session ended with the showing of a short film of the first flight of the Avro Arrow.

Of the Propulsion Section

The first Annual General Meeting of the Propulsion Section was held concurrently with the Meeting of the Test Pilots. Mr. D. H. Morrison, Interim Secretary, was in the Chair. Mr. Morrison gave a Report outlining the formation of the Section and the holding of its first election of Officers. Since this was the first meeting of the Section there was a good deal of discussion of the future programme, the building-up of membership and other topics raised in the Interim Committee's Report.

Members of the Test Pilots Section who attended the Meeting

After presenting Annual Reports: (l to r) Mr. H. C. Luttman (Secretary: who presented the Publications Committee and Specialist Services Committee Reports), Mr. P. B. Dilworth (Finance), CDR E. B. Morris (50th Anniversary), Mr. S. L. Britton (Long Range Planning), G/C H. R. Foottit, President (Report of the Council), G/C C. W. Crossland (Admissions) and Mr. J. L. Orr (Programmes)

Award winners: (l to r) Mr. J. C. Floyd (McCurdy Award), Lt.Gen. D. L. Putt, Mr. J. Young, Mr. J. H. Parkin (Honorary Fellows), Dr. A. E. Russell (Turnbull Lecturer) and Mr. C. I. Soucy (Baldwin Award)

HONOURS AND AWARDS

About 220 members and guests attended the Honours and Awards Session. After a brief explanation of the purpose of the session, the President announced the award of Honorary Fellowships to

Air Vice Marshal A. T. Cowley, RCAF (Ret)

Mr. J. H. Parkin

Lieutenant General D. L. Putt, USAF, and

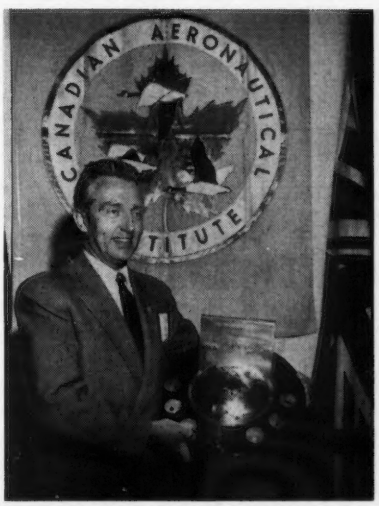
Mr. James Young

As each citation was read, the President presented the Certificate. Unfortunately A/V/M Cowley was unable to be there to accept his Certificate in person.

The President then announced that Mr. J. C. Floyd, Vice-President, Engineering, Avro Aircraft Ltd., had been selected as the winner of the McCurdy Award. In the absence of the Hon. J. A. D. McCurdy, the presentation was made by the President.

The F. W. (Casey) Baldwin Award was then presented to Mr. C. I. Soucy of the RCAF Air Materiel Command.

The last item was the delivery of the W. Rupert Turnbull Lecture by Dr. A. E. Russell, Director and Chief Engineer, Bristol Aircraft Ltd., but before giving his lecture Dr. Russell presented to the Institute, on behalf of Mr. H. W. Dunn of Bristol, a propeller designed by Dr. Turnbull in 1916.



Mr. J. C. Floyd and the McCurdy Award

Members of the Propulsion Section who attended the Meeting

Mr. W. K. Ebel, Vice-President, Engineering, Canadair Ltd., moved a vote of thanks to Dr. Russell at the conclusion of the Lecture and the session adjourned.

DINNER

As already stated, the Hon. J. A. D. McCurdy was not present at the Honours and Awards Session and was, therefore, unable to present the McCurdy Award as on previous occasions. However he attended the Dinner and, in introducing the Head Table, the President expressed his pleasure at seeing him there. The President commented, with regret, on the absence of a representative of the I.A.S., for the first time at a C.A.I. Annual Dinner, and he

read the following telegram from Mr. S. Paul Johnston.

"Regret pressure of events makes it impossible for Dexter or myself to be with you at the Dinner tonight. Best wishes for successful Meeting."

Before giving his Address, the President said that he was sure that he had the support of the Institute in a message which he had sent, a few days earlier, to His Royal Highness The Prince Philip, the Institute's Patron; the message was as follows:

"The fifth Annual General Meeting of the Canadian Aeronautical Institute will be held in Toronto on the 26th and 27th May. On behalf of the Council and members of the Institute, I have the honour to send to Your Royal Highness, as our most distinguished Patron, our good wishes and greetings at this time.

As on previous occasions, this message will be read to those attending the Annual Dinner on the 26th May and I am sure that it will receive wholehearted support; for Your Royal Highness' interest in the Institute has always given great pleasure and encouragement to all of us.

H. R. Foottit, President"

He then read the reply:

"I send my thanks to you and all members of the Canadian Aeronautical Institute attending the fifth Annual General Meeting in Toronto on 26th and 27th May for your kind message of greetings. I wish the Annual General Meeting every success and I am certain that the Institute will flourish. My best wishes to all those attending the Meeting.

Philip Patron."

This exchange of greetings was received with enthusiastic applause.

The President gave a brief outline of the development of the Institute, referring to its 9 Branches, 2 Sections and some 2,200 members and the extensive programme of technical meetings which it had established. He also mentioned the growing prestige of the Institute abroad, its being invited to participate in future Anglo-American Conferences and in the work of the International Council of the Aeronautical Sciences which was holding its First Congress in Madrid in September, and he paid tribute to the membership at large, whose work and active interest had earned this recognition. He said that he had been pleased and proud to be President of so vigorous a society and, on retiring from the Presidency, he expressed his gratitude to all concerned.

He then introduced the Principal Speaker, Dr. A. H. Zimmerman, Chairman of the Defence Research Board.

The Principal Speaker, Dr. A. H. Zimmerman

Dr. Zimmerman's Address, entitled "The Role of Science in Defence", appears in full at the beginning of this issue. The Speaker described the interdependence of the scientist and engineer, stressing the principle that the scientist should maintain the momentum of the quest for new knowledge and that the engineer, recognizing the long lead time inherent in modern engineering projects, should imaginatively guide the direction of research, so that new knowledge is available when it is needed. In thanking the Speaker Mr. E. K. Brownridge, Executive Vice-President, Orenda Engines Ltd., observed that it was reassuring to know that the part played by science in the defence of Canada was in such good hands.

As his last act as President, G/C Foottit thanked Mr. Ames and Mr. Braceland of the Toronto Branch for their arrangement and organization of the Meeting. He then transferred the President's Badge to Dr. G. N. Patterson, his successor.

G/C H. R. Foottit (President 1957-58) addressing the Dinner

The Dinner was adjourned by Dr. Patterson, after he said a few words of appreciation of the contribution made by the retiring Executive.

TECHNICAL SESSIONS

The programme of technical sessions is reviewed as follows:

Morning Session, May 26th
Engineering Administration

Reported by L. R. Nash

The Chairman, Mr. E. H. Higgins, started the session by stating that techniques of administrating engineering projects are of great importance to engineering administrators, but many engineers engaged primarily on technical work find the subject generally uninteresting. This attitude was unfortunate, as efficient engineering administration was very necessary for all engineering companies.

The first paper "The Arrow Weapon System and Organization for Service Management" was presented by W/C D. W. Goss, Branch Head, Office of the Assistant to the Chief Aeronautical Engineer, AFHQ.

W/C Goss introduced his subject by describing the Avro Arrow and its mission. To indicate the size and complexity of the Arrow Weapon System, the speaker noted the aircraft was about as large as the B-58 bomber and that some 17,000 drawings were released for the first aircraft built. Much additional plant space and facilities were required and over 5,000 people outside of Avro were employed in the manufacture of tools and parts, while some 650 firms became involved in the program. The necessary increased complexity of the Arrow Weapon System and the history of experience with CF-100 development indicated about a year ago that one agency should be primarily responsible for coordinating all aspects of the Arrow Weapon System rather than having the responsibility divided between numerous separate directorates within AFHQ and AMC.

USAF experience showed that control was best achieved through a Weapon System Project Office (WSPO) type of organization in which the WSPO consists of personnel from ARDC, AMC etc., with good back-up from laboratories and other scientific groups. The main advantages of WSPO control were that executive control for all technical aspects of the system rested with the WSPO chairman, while coordination was made easy because the team worked in one area and provided a single communications focal point for all contractors engaged on the project.

The RCAF rejected the appointment of one contractor to supervise the whole project because it was felt the Canadian Government and RCAF were not yet ready for the Ramo-Wooldridge type of operation and because it might handicap the RCAF in the ability to give good technical direction. The Office of the Assistant for the Arrow Weapon System (AAWS) was thus set up on October 11, 1957, as a government agency to exercise control over all contractors.

The Assistant for the Arrow Weapon System, or as he is called by the WSPO members – "The Wizard of Aaws" – has the prime function to coordinate all aspects of the Weapon System. He is responsible for determination of design requirements, specifications, Statements of Work, Schedules charts, reports, financial assessments for the complete Weapon System, plus recommended schedules and requirements for the Sparrow, the weapon's base facilities, training aids, construction, logistics support etc., to ensure a fully integrated Weapon System.

W/C Goss then explained the duties of the various branches within the AAWS team and the administrative tools used to achieve the management function. The latter included committees, designation of a coordinating contractor, Statements of Work, first use of RCAF Weapon Systems Specifications, use of specialists, machinery to process design and program changes, and the requirement that the coordinating contractor and associate contractors demonstrate the Weapon System against an established datum.

Following the paper, questions were asked on several aspects of the WSPO organization. It was rather interesting to hear that the committee system of control had been streamlined and made quite efficacious. A/V/M Hendrick commented that the AAWS had primarily an engineering function. It would be extremely difficult to find sufficient capable "Czars" who could control all the complex engineering involved plus all functions of the other numerous RCAF directorates and organizations involved in the many other projects under development in the RCAF.

The second paper "Some Applications of Parkinson's Law" was read by Mr. S. L. Britton, Chief Administrative Engineer of Orenda Engines Ltd. Mr. Britton presented an excellent case that the skills and training of engineers are needed just as much in the direction of control as they are in the direction of the purely technical operation. Many qualities necessary to a good creative or operating engineer are required by a good engineering administrator.

Engineering administration fundamentals, basic to almost any business, include planning, budgeting, scheduling, controlling and being sufficiently flexible to make adequate adjustment for deviations from the plan to ensure desired objectives are met. If these fundamentals are neglected, the resulting uncontrolled "rushing to get on with the job" usually spells disaster.

After explaining the purposes and techniques of sound engineering planning, budgeting, scheduling and control of projects, Mr. Britton described how the functional organization of the Administrative Engineering Division of Orenda, consisting of Project Control, Engineering Reporting, Administrative Services and Engineering Services, handled these important engineering administrative duties.

Although, Mr. Britton did not explain Parkinson's Law or even state it, I am sure that many "plumbers" in his audience will study C. Northcote Parkinson's book *Parkinson's Law* and other studies in Administration before embarking on a career in Engineering Administration.

Engineering Administration Session: (l to r) Mr. E. H. Higgins (Chairman), Mr. S. L. Britton and W/C D. W. Goss

Morning Session, May 27th
Production Engineering

Reported by C. N. Lucas

The session was chaired by Mr. D. P. Stowell, Vice-President, Manufacturing, Canadair Ltd., with approximately 100 members and guests in attendance.

Mr. Stowell introduced Mr. E. B. Bragg, Production Engineering Manager, Avro Aircraft Ltd., who spoke on the "Tooling Approach to the Avro Arrow Aircraft".

Mr. Bragg, in outlining the tooling approach, used the centre fuselage as an example and took us through the tooling procedure step by step, using slides to illustrate his points. He said that standard tooling had been used as much as possible and standard units, such as bases, posts etc., had been manufactured so that when a jig was no longer required these units could be used again, which also resulted in a saving of tool design hours by merely calling the standard on the tool drawing instead of detailing the item.

Machined parts tooling had been kept to a minimum on the programme to date.

A question and answer period followed.

Mr. Stowell then introduced Mr. F. W. Taggart, Chief Engineer, Aviation Electric Ltd., who spoke on the "Problems of Precision Production".

Mr. Taggart said there are really only two problems, the basic problem itself and the problem of recognizing the problem. He felt that enough people had not realized that in solving problems for the aircraft industry many new things were being discovered which enabled better washing machines, refrigerators etc., to be manufactured which could make living more comfortable.

He illustrated some of the work being done by going through their design of a "Ball Resolver". He stressed the necessity for the proper common understanding of the problem by all engineering and manufacturing factions alike and felt there was too much specialization by the various branches

Production Engineering Session: (l to r) Mr. E. B. Bragg, Mr. L. Vadeboncoeur, Mr. D. P. Stowell (Chairman) and Mr. F. W. Taggart

of Engineering Departments. He demonstrated the importance of asking the proper question in order to get the proper answer and felt that it was very important for everyone to understand the necessity of asking the proper question.

A further question and answer period followed.

Mr. L. Vadeboncoeur, General Manager, Jarry Hydraulics, was then introduced by Mr. Taggart. Mr. Vadeboncoeur spoke on the "Birth of an STOL Gear".

Mr. Vadeboncoeur, with the assistance of many slides, showed the tooling and manufacturing programme carried out on the Caribou Landing Gear. This landing gear required a telescoping gear and nosewheel steering. He illustrated the very close tolerances required in the manufacture of many units, particularly in the valves. He illustrated the procedure for the manufacture of the CL-28 Bogie Beam manufactured from 7079 S and outlined a number of the problems they had had in its manufacture. He showed a number of special purpose machines that Jarry Hydraulics had manufactured for dealing with the many complex problems arising in the manufacture of other various undercarriage programmes.

This was also followed by a question and answer period.

Mr. Stowell then thanked all of the speakers and brought the session to a close.

Mr. Stowell chaired this session in admirable fashion, assisting the speakers by giving them adequate introductions and leading the question and answer period so that questions were asked spontaneously.

Morning Session, May 27th
Design and Application of Computers

Reported by A. Grzedzielski

The session on Computers was under the chairmanship of Mr. F. W. Pruden of the National Research Council. Some two hundred members attended and obviously appreciated the papers presented by the four lecturers.

Mr. Pruden introduced Mr. G. S. Glinski, Canadian Regional Manager, ElectroData Div., Burroughs Adding Machine of Canada Ltd., who spoke on "Electronic Computers in Aviation Industry".

The lecturer surveyed some of the more important and controversial aspects of computer use. Against the usual contention that the computers are here to reduce man's efforts, he would like to maintain that the true purpose of these devices is to increase man's capacity for solving problems. He subdivided computers into continuous and discrete, the latter being subdivided further into sampled, quantized and digitalized. Speaking on the organization of the computing work, he distinguished two phases:

(1) Programming and debugging
(2) Production of data

then three groups of people:

(1) Customers
(2) Programmers
(3) Operators.

In order to compare the cost of various computer installations, one should presume the same input and output and take time into consideration. He warned of the accounting approach to the cost problem which may never cope with the dilemma of saving money which has not been previously spent on work which has not been previously done. A comparison of three methods of doing computing work – by hand, by small computer and by large computer – was presented. Finally the lecturer discussed various applications in the aircraft industry.

The second speaker, Mr. A. O. Downing, Chief of Digital Computing, Avro Aircraft Ltd., was then introduced by Mr. Pruden. He spoke on "Applications of a Large Scale Digital Computer in Aircraft Design and Development".

There is always great pleasure in listening to men who speak on what they have done and not on their projected work. Mr. Downing described briefly

Computer Session: (l to r) Mr. A. O. Downing, Mr. F. W. Pruden (Chairman), Mr. J. M. Tusiewicz, Mr. W. S. Kozak and Mr. G. S. Glinski

the IBM 704 installation of the Company and went on to discuss the various problems he met and contributed to their solution: flutter calculations, structural analysis, transient thermal problems, flight data reduction, stability and control etc. He spoke at length on the task of the programming service, on the solution of the flutter determinant, on large matrix operations, and quoted data concerning time and reliability of digital computation. Then he described organization of the computing work at Avro which takes place on the closed shop basis. The interested engineers present formulated and mathematically cleared problems to the programmers. A programmer takes the problem through the various phases up to the final solution; however, the programmer does not operate the machine which is left with professional and specially trained operators.

Finally, Mr. J. M. Tusiewicz, Chief Performance Engineer, Lucas-Rotax Ltd., was introduced by Mr. Pruden and spoke on "Computer Application to Fuel System Design and Development".

As the paper summarizing the lecture was not available and this writer is not acquainted with the problems of fuel system design, no reporting is possible beyond the remark that in a well prepared lecture, the problems of fuel distribution were discussed, and the test facilities of Lucas-Rotax were described.

Mr. Pruden then introduced Mr. W. S. Kozak, Computer Engineer, Electronics Div., Air Armament Dept., Can. Westinghouse Co. Ltd., who spoke on "The Application of Analogue Computers to Guided Missile Design".

The lecturer discussed the advantages of analogue versus digital techniques in missile work, the determining factor being complexity of equipment, accuracy and speed of computation. The digital computer is most suitable for slowly varying variables, such as the flight path trajectory, while the analogue computer is indispensable in studying missile stability. Mathematics of missile engineering seem to be quite formidable. Not only are there 18 simultaneous differential equations to be integrated but many other phenomena have to be considered, such as radar cross talk and target noise. Since any exact solution is out of the question, extensive testing is required. This is done by means of various test devices simulating real conditions, such as target range, missile roll etc. The test devices include analogue computers working in real time. The lecturer described testing equipment and methods used by Canadian Westinghouse Co. Ltd.

Ground Equipment Session: (l to r) Capt. C. G. H. Daniel, G/C W. P. Gouin (Chairman), S/L W. M. McLeish and Mr. J. F. Louv, Jr.

Afternoon Session, May 27th
Ground Equipment

Reported by T. David

Three papers were presented to a well attended meeting under the chairmanship of G/C W. P. Gouin, Senior Logistics Co-ordinating Officer, Air Materiel Command Headquarters, RCAF.

The paper entitled "RCAF Emergency Runway Barrier Development" was presented by S/L W. M. McLeish, Officer Commanding Airworthiness Projects at the RCAF Central Experimental and Proving Establishment.

S/L McLeish established the requirement for emergency airfield barriers based on jet fighter operational experience, particularly from the short runways of forward tactical airfields. Reference was made to the USAF chain-type energy absorber. RCAF/CEPE evaluation of this equipment shows the type to be inadequate for the heavier RCAF fighter aircraft. Tests carried out with CF-100 aircraft at maximum weight 34,000 lb and energy absorption up to 24 million foot pounds have highlighted the chain handling problems and the time necessary for resetting after use.

As RCAF have an immediate requirement for absorbing up to 28 million foot pounds it was decided to investigate alternative forms of arresting devices.

The testing of an hydraulic arresting device was described and its development potential indicated. This form of arrester consists essentially of a water-filled pipe on each side of the runway, in which pistons attached to the arresting wire are free to travel. The pipes are graduated in steps to offer progressively increasing resistance with arrester wire pull-out. Each pipe contains approximately 750 gallons of water/glycol mixture, with the pipe buried below ground level for anchorage.

It was reported that tests of an improved barrier and pick up device for the undercarriage engagement wire in conjunction with the hydraulic engine had proved very successful. Installation at all RCAF fighter bases is proposed. Development of this installation to absorb up to 90 million foot pounds of energy is anticipated for possible use with the CF-105, although the actual mechanism of engagement with this aircraft has not been resolved.

It was anticipated that there may be useful applications for commercial airlines, although up to the present time very little has been done in this direction.

Considerable interest was shown in the lecture and of the questions asked, one elicited the reply that it was not RCAF policy to develop aircraft arresting for regular use; the operations discussed were strictly emergency mode only.

The second paper was presented by Mr. J. F. Louv, Jr., General Manager of the Consolidated Diesel Electric Corporation of Canada Ltd. His paper was entitled "Weapon System Ground Support".

Mr. Louv outlined the background and history of the weapon system concept, describing how it evolved from a World War II requirement for the most efficient deployment of resources and materials to perform assigned tasks.

The present concept as it applies to aircraft, missiles and ground support

was discussed. The range, quantity and costs of ground support equipment were shown to be increasing at a terrific rate. In fact, of a 1958 fiscal year budget of 1.4 billion dollars for USAF missile programmes, approximately 75% was absorbed by ground support equipment. This shows a complete reversal of previous experience with manned aircraft where ground support equipment costs did not usually exceed 30%.

It was anticipated that the advent of nuclear power units and space travel would open vast new fields in equipment design and that the opportunity should now be taken to achieve some standardization.

The author suggested that standardization of ground support equipment should be effected through a central authority who would be responsible for horizontal integration of all the requirements for various weapon systems.

The subsequent lively discussion revealed differences in opinion on the correct approach to the design and provision of ground support equipment.

An alternative point of view, supported from the floor, was that standardization should be the responsibility of the design authority responsible for each weapon system. Unfortunately, time curtailed this discussion.

The final paper in this session was entitled "Aircraft Carrier Equipment" and was presented by Capt. C. G. H. Daniel, the Assistant Chief of Naval Technical Services (Air) RCN.

Capt. Daniel reviewed the early history of aircraft operations from the flight decks of converted merchant ships and traced the development of the art to the present day.

The major equipment required for the operation of modern high speed aircraft from carriers was discussed and illustrated with slides. In the main, the equipment consists of hydraulic arrester engines suitably connected to arrester wires laid across the touch down area; double-barrelled steam operated catapults of slotted tube design, operating a common shuttle; safety barriers to catch aircraft which missed the arrester wires; and the mirror landing sight.

The layout of the angled flight deck and its many advantages were presented, together with illustrations of Royal Canadian Navy carriers embodying this feature.

Captain Daniel pointed out that there had been an appreciable decline in the accident rate since the advent of the angled deck and mirror landing sight, which together with the steam catapult had all originated in the Royal Navy.

A remarkable film was shown, which, as Captain Daniel put it, "had been spliced up" to show the hazards of flight deck operations in the early days, in contrast with the high standard of efficiency now attained.

Suggestions were invited for some means of retrieving the wire rope bridles used for connecting the aircraft to the catapult shuttle. These are at present lost overboard.

Afternoon Session, May 27th

VTOL/STOL

Reported by D. C. Whittley and J. Fletcher

The last session was chaired by Mr. J. L. Orr, Director of Engineering Research, Defence Research Board, who introduced the first speaker, Mr. R. L. Wardlaw, Research Engineer, National Research Council. His paper was entitled "Some Aerodynamic Characteristics of Wing-Mounted Lifting Fans for VTOL Applications".

The lecturer described some wind tunnel experiments carried out on a two dimensional wing in which was embedded a high-solidity fan. This work represents one of the first attempts to test such a configuration and it shows quite clearly the predominant effects of the fan on wing characteristics.

Application of such a wing-fan combination in the field of VTOL was stated to be in connection with a dual-purpose gas turbine powerplant. The engine operates in a conventional manner in cruising flight whereas for hovering it is used as a gas generator to provide power to the fan, either directly or by means of a shaft drive. Transition from hovering to forward flight would be accomplished by first deflecting the fan jet through a small angle and then gradually transferring power from the fan to conventional jet propulsion.

In order to make the tests more generally useful, the results were compared with a simple momentum theory. By this means it was possible to carry out certain project studies.

Experimental data were expressed as a function of V/nd and during the discussion period it was suggested that possibly C_J, the jet coefficient, might provide a more useful parameter.

Flow visualization studies were made in the water tunnel on a small model similar to that used in the wind tunnel. The flow pattern was made visible by illumination of small aluminum particles. Motion pictures were shown of these experiments and they represented the highlight of the session.

Due to the illness of Mr. E. B. Schaefer, the second paper in this session, entitled "VTOL Configuration Studies", was presented by Mr. F. C. Phillips, Project Engineer, Canadair Ltd. In it he outlined five possible configurations studied to fulfil a DRB specified mission. For security reasons, the exact details of this mission could not be disclosed; however, the forward speed required, along with VTOL characteristics, precluded any consideration of the helicopter configuration. The specification also required an extremely low "foot print" pressure which made landing gear design extremely difficult. Briefly, the configurations studied were:

(1) Slip stream deflecting wing
(2) Tilting wing
(3) Wing tip propellers in rotatable circular ducts.
(4) Small jet engines vertically mounted on the fuselage for VTOL
(5) Small jet engines buried in the aft portion of the wing, which swung down to a vertical position for

VTOL/STOL Session: (l to r) Mr. J. L. Orr (Chairman), Mr. F. C. Phillips and Dr. D. H. Henshaw. Unfortunately we have no photograph of Mr. R. L. Wardlaw

VTOL, balance being provided by small jet engines mounted on the fuselage fore and aft of the wing

From considerations of available research, estimated development work required, production costs and capacities of available power units, it was concluded that configurations (1) and (2) merited further study.

The final paper was presented by Dr. D. H. Henshaw, Aerodynamicist, De Havilland Aircraft of Canada Ltd. The paper was entitled "Experimental Techniques in the Development of STOL Aircraft" and gave a description of the rig used at De Havilland for STOL investigations. An Otter aircraft is mounted on a rigid-wheeled stand which is towed down the runway by a truck. The aircraft is connected to the stand at the main and tail wheel positions, two component force balances being used at the main wheels and a single component force balance at the tail. Through adjustment of the tail wheel support, the angle of attack of the aircraft could be varied through a large range. Smoke patterns and rakes are being used to study flows for various speeds, angles of attack and different flap combinations.

Although the test rig is rather particular in character, Dr. Henshaw expects results obtained will have a general application.

Copies of Papers

Preprints of the papers presented at the Annual General Meeting on the 26th and 27th May are obtainable from the Secretary.

The audiences at two sessions

A/V/M M. M. Hendrick
W/C P. de L. Markham
W/C C. R. Thompson

Those who helped

Mr. R. Parker
Mr. J. W. Ames

Miss J. Sutcliffe
Miss J. M. White
Mrs. V. Noseworthy
Mrs. G. G. Ross

Mr. E. H. Higgins
A/V/M A. Ferrier
Dr. J. J. Green
Mr. J. C. Floyd

HONOURS AND AWARDS

THE presentation of the Institute's honours and awards preceded the delivery of the W. Rupert Turnbull Lecture at a special session of the Annual General Meeting on the 26th May, 1958. The ceremony also included the presentation, to the Institute, of a propeller designed by Dr. Turnbull for the Sage 3 Seaplane in 1916.

The President, G/C H. R. Foottit, was in the Chair.

HONORARY FELLOWS

The proceedings opened with the announcement of four Honorary Fellowships; to Air Vice Marshal A. T. Cowley, RCAF (Ret), Mr. J. H. Parkin, Lieutenant General D. L. Putt, USAF, and Mr. James Young. As the President announced each name, he called upon the Secretary to read the citation and then invited the recipient to come forward onto the rostrum to receive his Certificate. Unfortunately A/V/M Cowley was not present at the ceremony to accept his Certificate from the President's hand.

The citations were as follows:

Air Vice Marshal A. T. Cowley

Air Vice Marshal A. T. Cowley has had a long and distinguished career in Canadian aviation. After graduating in Civil Engineering from McGill University, he learned to fly at his own expense and was commissioned in the Royal Naval Air Service in 1915. During one of his raids he was forced down in enemy territory and spent the remainder of World War I in prison camp.

In World War II he was Director of Air Force Manning, Air Member for Organization and Air Officer Commanding Nos. 1 and 4 Training Commands. He was awarded the C.B.E. for his outstanding service.

Between and after the wars Air Vice Marshal Cowley served as Superintendent of Air Regulations, Controller of Civil Aviation and Director of Air Services, Department of Transport. In these capacities he contributed greatly to the development of civil aviation in Canada.

He retired in 1954 but his hobby is still flying. He has flown almost 200 different types including jets. Throughout his career his enthusiastic and dynamic personality have been an encouragement and inspiration to all who worked with him.

Mr. J. H. Parkin, Honorary Fellow

Mr. J. H. Parkin

Mr. J. H. Parkin is built into the foundations of Canadian aviation. As some of you will know, he started aeronautical research work in 1917 and organized the first aeronautical engineering course in this country, at the University of Toronto in 1928. In 1929 he moved to the National Research Council where, as Director of the Division of Mechanical Engineering, he proceeded to set up extensive aeronautical laboratories. Since that date, these laboratories have grown steadily and have played an important part in the development of Canadian aviation.

Mr. Parkin is one of the pioneers of aviation research. He has performed no mean feat in training a large number of now eminent engineers; and by his determination, energy and steadfastness of purpose, he has contributed directly to a large number of fruitful developments. This Institute is proud of his achievements.

Lt.Gen. D. L. Putt, Honorary Fellow

Lieutenant General D. L. Putt

Lieutenant General D. L. Putt has been Commanding General of the USAF Air Research and Development Command and, more recently, Deputy Chief of Staff, Development, USAF.

In these two important positions General Putt has shown himself to be a very staunch friend of Canada and has done everything in his power to foster closer relations between Canada and the USA in those fields for which he has been responsible. He has demonstrated a depth of understanding and sympathy for the Canadian point of view which has been very greatly appreciated.

Largely due to the efforts of General Putt and his staff, arrangements have been made whereby the USAF and the Defence Research Board will integrate their research programmes in several areas. Furthermore the very comprehensive research and development information made available to the RCAF by the USAF and the extensive visits by Canadians to USAF Research and Development Establishments are, to a great extent, attributable to the spirit of cooperation which General Putt has inspired.

General Putt is not only an outstanding figure in the realm of aeronautical research and development but one who has done much to promote friendly cooperation between his country and our own.

Mr. James Young, Honorary Fellow

Mr. James Young

Mr. James Young was born in London, England, in 1883 and received his early technical training in Manchester. In 1905 he went to the USA and joined the Pratt & Whitney Machine Tool Division of the Niles-Bement-Pond Corporation at Hartford. He returned to

England as representative of the Pratt & Whitney Company and remained there seven years before being appointed to head the shop operations of John Bertram Ltd., at that time a subsidiary of Niles-Bement-Pond, at Dundas, Ontario. This was his entry to Canada – in 1913.

From 1915-18 he served with the 13th Battalion, Black Watch of Canada, and was twice wounded.

In 1926, he was appointed Vice-President of John Bertram and Sons Company Ltd., from which he resigned in 1928 to organize Canadian Pratt & Whitney Aircraft Company Limited. He was President of this new company until 1948 when he became Chairman of the Board. In 1941 he also formed and was appointed President of Canadian Propellers Limited, which manufactured Hamilton Standard Propellers during the war.

He was a Director of the AITA from 1939 to 1941 and its President in 1941/42. From 1946 to 1951 he was a member of the Executive Council, Canadian Chamber of Commerce.

Mr. Young, in his long association with Canadian Pratt & Whitney Aircraft, has made a most important and significant contribution to Canadian aviation.

THE McCURDY AWARD — 1957

The McCurdy Award, for outstanding contribution in the aeronautical technical field, has been regarded as the Institute's premier award, since it was introduced in 1954. (It was introduced by the Institute of Aircraft Technicians simultaneously with the merging of the IAT with other aeronautical groups in Canada to form the CAI.) The Award consists of a Trophy and a Silver Medal. Each year in the past it has been presented personally by the Hon. J. A. D. McCurdy but on this occasion he was unfortunately absent and the presentation was made by the President.

Mr. J. C. Floyd, McCurdy Award

Mr. J. C. Floyd

The President announced that Mr. J. C. Floyd, Vice-President, Engineering, Avro Aircraft Ltd., had been selected as the winner of the McCurdy Award for 1957 and, after the Secretary had read the citation, Mr. Floyd mounted the rostrum and received the presentation. In a brief address of thanks he paid tribute to all the members of the Avro engineering team and to the RCAF Directorate headed by G/C Foottit which had been responsible for the co-ordination of the Arrow Weapon System Project.

The citation was as follows:–

Since he came to Canada from England in 1946, Mr. J. C. Floyd, Vice-President, Engineering, of Avro Aircraft Ltd., has materially influenced the course of Canadian aviation. His sustained leadership over several years, in co-ordinating the activities of a very large and competent engineering team, has been a dominant factor in the creation of the CF-100 and the Arrow, two outstanding first-line fighters designed and manufactured in Canada. He has carried his responsibilities not only with efficiency but with vision and enterprise.

The extremely advanced conception of the Arrow (CF-105) demanded very great effort from the Avro engineering group. It has been a major aeronautical development of a magnitude and complexity never before attempted, probing into fields far beyond the state of the art and fraught with innumerable unknown difficulties. The responsibility for the many decisions which had to be made in the design stages of such an aircraft rested to an unusually large degree upon Mr. Floyd. The quality of his technical judgement and of his infectious energy may be measured by the speed with which the project has been carried through. The factory completion of the first Arrow last year is a tribute to his direction of this very exacting engineering programme.

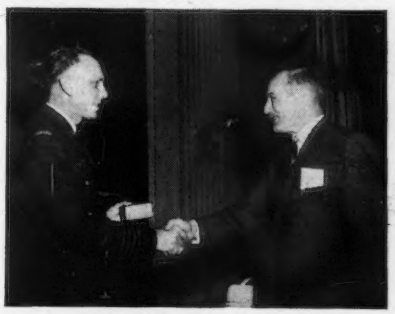
For this important contribution that Mr. Floyd has rendered to the Canadian aircraft industry during the last twelve years, culminating in the design and development of the Avro Arrow, he has been selected as the winner of the McCurdy Award for 1957.

F. W. (CASEY) BALDWIN AWARD

The F. W. (Casey) Baldwin Award was introduced in 1957 and is given to the author of the best paper, in terms of originality of material and writing skill in presentation, published in the Canadian Aeronautical Journal during the preceding calendar year. (The W. Rupert Turnbull Lecture, which is invariably published in the Journal is excluded from this competition.) The Award consists of a Silver Medal.

Mr. C. I. Soucy

The President explained the purpose of this Award and announced that the winner was Mr. C. I. Soucy of the RCAF Air Materiel Command, for his paper entitled "Reliability Control of Electronic Equipment in Aircraft and Weapon Systems: General and Management Aspects". This paper had appeared in the Journal in September 1957. He then called upon Mr. Soucy and presented the Medal to him. Mr. Soucy said a few words expressing his thanks and pleasure.



Mr. C. I. Soucy, Baldwin Award

THE TURNBULL PROPELLER

Before proceeding to the W. Rupert Turnbull Lecture, the President alluded to the two-bladed wooden propeller on the table in front of him and read the following letter from Mr. H. W. Dunn of Bristol.

"A few weeks ago Dr. A. E. Russell told me he was delivering the W. Rupert Turnbull Lecture before the Canadian Aeronautical Institute.

"During the course of our conversation I mentioned to him a propeller which I had in my possession designed for the Sage 3 aircraft in 1916 by W. Rupert Turnbull, or 'Papa' Turnbull as he was affectionately known.

"He was one of a small team engaged on new aircraft design work with the Aircraft Group of Fredk. Sage & Co. Ltd. of Walton, Peterborough. This group was headed by two ex Bristol Company pioneers, Mr. E. C. Gordon England as General Manager and Mr. Clifford Tinson as Chief Designer. Wallace Rupert Turnbull was the Aerodynamics Chief.

"A few members of the original team are still in the Aircraft business in England and one – Arnold G. Parker – is in the Aircraft industry in Montreal.

"The propeller came into my possession after the 1914-18 war when I acquired it from a sale at Sage's of surplus aircraft materials.

"It gives me great pleasure to present this propeller to the Canadian Aeronautical Institute in memory of Wallace Rupert Turnbull and it is an added pleasure that the presentation can be

Dr. A. E. Russell presenting the propeller on behalf of Mr. H. W. Dunn

made at this time when Dr. A. E. Russell (with whom I worked for 30 years or so before my retirement last year) is giving the 4th W. Rupert Turnbull Lecture.

"I would like to record my thanks to the RCAF for the generous help which they have given in conveying the propeller from England to Canada."

Dr. Russell, on being asked by the President to make the presentation on Mr. Dunn's behalf, spoke briefly of his long association with Mr. Dunn and of Mr. Dunn's interest and enthusiasm in giving this memento of Dr. Turnbull to the C.A.I.

W. RUPERT TURNBULL LECTURE

The W. Rupert Turnbull Lecture was introduced by the Institute in 1955 to commemorate the pioneering work in aeronautical engineering carried out by Dr. Turnbull of Rothesay, N.B. Each year the Council invites an eminent scientist or engineer to deliver the Lecture before the Institute and it has been customary to invite Canadians and non-Canadians in alternate years. The Lecturer receives a Certificate and an honorarium.

Dr. A. E. Russell, Turnbull Lecturer

Dr. A. E. Russell

The President introduced Dr. A. E. Russell, Director and Chief Engineer, Bristol Aircraft Ltd., as the fourth W. Rupert Turnbull Lecturer. Dr. Russell's paper was entitled "Some Recent Aids to Aircraft Design".

Professor B. Etkin of the University of Toronto has reported upon it as follows (the full Lecture will be published later in the Journal):

"Dr. Russell focussed attention in his lecture on the tremendous changes which have taken place in the process and methods of airplane design during recent years. In the early days, design was a rapid procedure involving much intuition and inspiration and a limited amount of theory and research. The wind tunnel was the only research tool required and the principal aid to calculation was the slide rule. Proving the integrity of a design after it was built usually involved no more than some simple static loading of an inverted airplane.

"By contrast, the present day picture is vastly more complicated. In the first place, the larger size and weight of modern civil and military flying machines, coupled with their high performance, has created a situation in which the number of engineering manhours required has gone up by a factor of about 20. The "designer" today is not an individual, but a team. One man alone cannot hope to cope with either the magnitude or the complexity of a modern airplane or missile design.

"The tremendous investment involved in producing one of these modern machines makes it mandatory to reduce the risk of failure to meet the specifications to the vanishing point, while at the same time confining the design process to a reasonable time interval. These two requirements, taken together, have forced the industry into large-scale analysis and testing programs, the like of which were not imagined twenty years ago.

"Dr. Russell described the two main tools of analysis, the digital and the analogue computer, and gave a number of interesting examples of their application to important problems in aerodynamics, structures, stability and control, aeroelasticity, and test data reduction.

"Dr. Russell also described the great strides which have been made in testing. He stated that these were necessary because theoretical studies are rarely regarded as infallible! Among the very interesting testing techniques which he described in some detail, we may list the following: wind tunnel flutter models, free flight rocket-powered flutter models, full scale flight flutter testing; structural testing using strain gauges, fatigue testing machines, fuselage water tank fatigue tests; kinetic heating simulation; and acoustic tests. In some of the testing programs, temperatures and external loads are programmed to simulate actual operational cycles.

"In concluding, Dr. Russell stated that when the chance arises to inspect aircraft of the pre-war era, one realizes that the engineering standards of that time were comparatively uncomplicated and that sophistication was just beginning to emerge. He noted that the designers of that time were no less competent than those of today and that their personal sense of achievement was possibly greater."

At the conclusion of the Lecture, the President called upon Mr. W. K. Ebel, Vice-President, Engineering, Canadair Ltd., who expressed the Institute's appreciation and moved a vote of thanks to Dr. Russell, which was warmly accorded.

ANNUAL REPORT

Of the Council

1957-58

A YEAR ago the C.A.I. had reached a critical stage in its development, particularly with regard to its Headquarters establishment and the almost embarrassingly healthy state of its finances. It was clear that the time had come for a major step forward – for an expansion of its services, if necessary at some expense to its financial reserves – and this rather difficult transition has now been successfully accomplished. By all counts it has been an eventful year, as this report will show.

COUNCIL AND EXECUTIVE

The full Council has met three times during 1957-58, once immediately after being appointed at the Annual General Meeting last May, once in Montreal on the occasion of the joint I.A.S./C.A.I. Meeting in October, and once in Vancouver at the time of the Mid-season Meeting in February. In addition it met here in Toronto with the new Council to hand over the administration of the Institute's affairs.

There has always been some difficulty in holding full Council meetings because the terms of the Bylaws are extremely demanding. They require that a member from each Branch should be present to constitute a quorum and, with eight Branches distributed from coast to coast, this is a very brittle arrangement; if, on any occasion, one Branch fails to send a representative, the Councillors from other Branches would have made their journeys in vain. To eliminate this risk, a form of proxy was introduced this year, though Councillors were urged not to take advantage of it, and it is gratifying to record that, with only two exceptions, representatives from all the Branches were present in person at all the Council meetings.

The Executive Committee of the Council, comprising Council members from Ottawa, Toronto and Montreal, has met five times, to conduct routine business and advise the Secretary on current problems. The Council has been kept fully informed of the Committee's work and has been consulted by mail on the more important questions.

COMMITTEES

Seven committees have served the Council this year. In addition to the usual four, namely Finance, Admissions, Publications and Programmes, and the Specialist Services Committee introduced in 1956-57, two new committees were set up; these were the Long Range Planning Committee and the 50th Anniversary Committee. Each committee reports separately but the following is a brief summary of the work they have done for the Council during their terms of office.

Finance

The Finance Committee has been directed by Mr. P. B. Dilworth, a member of the Council, and its members have been Mr. L. D. Clarke, Mr. J. F. Taylor and the Treasurer. The Committee has worked closely with the Long Range Planning Committee – to which reference will be made later – and has managed the finances of the Institute very capably in the face of difficult, changing conditions – increases in staff and equipment and other Headquarters developments.

Perhaps its most important work has been a study of the Institute's dues structure. The revised scale of membership dues which the Committee recommended was approved by the Council and subsequently accepted by vote of the general membership last November; it was put into effect on the 1st April, the beginning of the current fiscal year. The Council believes that this measure was wise and timely, much as everyone deplores the increasing cost of everything nowadays; for it has enabled the Institute to forgo further financial assistance from the Royal Aeronautical Society, the Institute of the Aeronautical Sciences and the Engineering Institute of Canada and, moreover, it has established a more healthy relationship between the support derived from members' dues and that derived from contributions from Sustaining Member companies.

Admissions

The Admissions Committee has once again been guided by G/C C. W. Crossland who served as Chairman for a fourth year. In accordance with the recommendations of the previous Council, a new arrangement was adopted this year and, instead of having a member in every Branch, the Admissions Committee has consisted solely of G/C Crossland, Mr. J. C. Finlayson and Mr. C. D. Long, all of Ottawa. Because of its Chairman's experience and the fact that its members could meet frequently to discuss each case in detail, this Committee was invested with full powers of admission, without reference to the Council except in cases of disagreement or doubt. This innovation has resulted in more rapid processing of the applications and there is every reason to believe that the standards of grading have been consistently maintained.

Publications

The Publications Committee appears to have upheld the very creditable quality of the Journal, which remains one of the most important services of the Institute. As in the past, in order to be readily available for consultation by Headquarters staff, the Committee has been located in Ottawa. Mr. A. H. Hall has been its Chairman and Mr. G. Glinski, Mr. R. J. Templin and Mr. J. A. Dunsby have served as its other members.

In spite of its growing reputation, the Journal is still handicapped by a dearth of good material and the Committee has given considerable thought to this problem. Ultimately, of course, the solution must rest with the membership; there is no doubt that among the members of the Institute there are plenty of potential authors, doing work which would be of interest to others; the difficulty is to get them to recognize this interest and to record their work in the form of papers, notes and correspondence suitable for publication.

Financially the Journal continues to pay for itself by a small margin, so far as printing and distribution costs are concerned. But the margin is uncomfortably small and some increase in advertising revenue is desirable. S/L W. M. McLeish has been helping the Publications Committee with a special project on this subject of advertising sales, which should bear fruit in the coming year.

The Council would like to thank the members of the Editorial Board, who, without credit or recognition, have studied and assessed every paper submitted for publication during the year.

Finally no review of the Institute's publications would be complete without a tribute to Mrs. Ross, Assistant to the Secretary, who has managed to edit and produce the Journal (and the List of Members) almost single-handed, in addition to the performance of her many other duties.

Programmes

The Programmes Committee has a major responsibility in laying out the Institute's meetings. It must also give what help it can to the Branches, notifying them of speakers visiting their areas and so forth. Because of the importance of this work, the Chairman of the Programmes Committee is traditionally a member of the Council and this year Mr. J. L. Orr has filled the post; the other members have been the Chairmen of the Branch Programmes Committees, Mr. R. E. Klein of Toronto, Mr. F. C. Phillips of Montreal, Mr. H. H. Kelland of Ottawa, Mr. C. E. B. McConachie of Vancouver, Mr. R. P. Hughes of Winnipeg, F/O A. J. Robinson of Edmonton, S/L J. C. Olson of Cold Lake and Mr. R. Wallworth of Halifax-Dartmouth.

The programme which this Committee has provided this year will be described later. As to future planning, the Committee has prepared a chart of the staple subjects for sessions – such as aerodynamics, structures, propulsion, airline operations, education and training, electrics and electronics – and has laid them out, recurring in suitable frequency, in the years ahead. This overall plan provides a framework to which topical subjects (the current ones are perhaps VTOL/STOL and Space Travel) can be added at relatively short notice. The dates and places of the Institute meetings to the end of 1961 have also been established and accommodation has been reserved.

Specialist Services

The Specialist Services Committee has been located in Vancouver this year, under the Chairmanship of Mr. R. J. McWilliams. Mr. J. Bertalino, Mr. H. D. Cameron, Mr. J. R. H. Hutton and W/C J. W. McNee have provided a committee membership of a wide range of interest and experience. This Committee has formulated and put forward recommendations for a country-wide scheme of Student Awards, which the Council has adopted and which will be introduced in the coming year. In addition the Committee has developed a proposal for a Thesis Topics List, similar to that used by the I.A.S. Both of these projects provide excellent examples of the way in which the Specialist Services Committee can suggest new fields of Institute endeavour.

Long Range Planning

As has been said, it was recognized a year ago that the Headquarters establishment was overloaded and that the Institute was accumulating surplus funds, which ought to be used in the service of its members. An expansion of Headquarters staff and facilities seemed to offer a ready solution to both problems. However, any expansion would have to be a major one, involving not only additional staff and equipment but also a move to larger quarters. It seemed prudent to have a good look before leaping and to lay out some fairly specific plans for the next four or five years. To this end a Long Range Planning Committee was appointed, under the Chairmanship of the Vice-President, Mr. S. L. Britton, and comprising, in addition, Mr. I. A. Gray, Mr. I. M. Hamer and Mr. J. P. Uffen.

This Committee held an important meeting with the Finance Committee last July and subsequently produced a series of charts forecasting the development of the Institute's services to its members, and the growth of its membership and budget, to the year 1961-62. These charts have proved to be of great assistance to the Council and have provided a background against which such steps as the expansion of the Institute's Headquarters could be planned and financed in a businesslike manner. Copies have been sent to all Sustaining Members.

50th Anniversary Committee

Because the year 1959, the 50th Anniversary of Powered Flight in Canada, was likely to entail some rather special planning, the Council appointed a 50th Anniversary Committee to develop some ideas and to recommend activities appropriate to the occasion. CDR E. B. Morris, a member of the Council representing the Halifax-Dartmouth Branch, was appointed as its Chairman, for the very good reason that all plans were likely to be centred on Nova Scotia, where the first flight took place. CDR N. A. Smith, also of the Halifax-Dartmouth Branch, was appointed to serve with him. Working with the Secretary, who has represented the Institute on a body known as the National Coordinating Council for the Golden Anniversary of Flight in Canada, this Committee has put forward some interesting proposals, which will be mentioned later in this report.

HEADQUARTERS

So much for the Committees; now to turn to developments at Headquarters. On the basis of the long range planning, the Council authorized an increase in the Headquarters establishment amounting to about 50%, both in office space and staff. A move to larger premises took place in October and, in December, W/C H. L. Taylor was appointed Assistant Secretary.

Last September the Secretary was sent to England to represent the C.A.I. at the Anglo-American Conference. He kept his eyes and ears open and had some useful conversations with both R.Ae.S. and I.A.S. Officers; he came back full of ideas for the better administration of the Institute and the improvement of its meeting arrangements.

BRANCHES AND SECTIONS

The eight Branches have staged full programmes during the year and all of them have increased their memberships. The formation of one new Branch, at Calgary, has recently been approved by the Council; the long-established little group of members in Calgary are to be congratulated on attaining Branch status.

The Student Sections of the Toronto and Vancouver Branches continue to flourish and the Ottawa Branch has organized an enthusiastic Student Section at the R.M.C. Kingston. Progress has also been made in the rather difficult task of organizing an effective Student Section in Montreal. It almost goes without saying that a Student Section, at the Provincial Institute of Technology and Art, will quickly develop as a major feature of the new Branch at Calgary. In so far as it is a function of the Institute to develop, in this country, a sense of professional association, with broad common interests in the technical field, the Council lays great importance on these Student Sections; for the future of Canadian aviation rests with the Student members and the Institute should do its utmost to help and encourage them.

One new Specialist Section has been added since the Test Pilots Section was formed in 1956-57. This is the Propulsion Section (which was forecast in last year's report as the "Rocket Section"). The new Section was formed only this spring and has not yet become fully organized, but it has held an election of its first Officers and its first business meeting will take place during this Annual General Meeting of the Institute. The American Rocket Society has taken a great interest in the formation of this Section and has generously offered to cooperate in its work.

It is perhaps premature to say very much about the proposed Astronautics Section, except that an Interim Committee has been appointed to make preliminary plans. This Committee consists of Dr. G. N. Patterson, Mr. R. J. Templin and Dr. M. G. Whillans. It has been argued in some quarters that the Institute should not concern itself with astronautics, that astronautics and aeronautics are separate subjects. This is no more than a play upon words – one might as well say that navigation is not applicable to anything that does not travel upon the sea. Clearly astronautics is a natural extension of aeronautics and the Institute must extend its interests into outer space; a Specialist Section offers a convenient medium for such a venture but a Canadian Astronautical Society – in fact two of them – is already in existence and the possibilities of some form of affiliation are being explored.

MEMBERSHIP

The membership at the end of March was 2,121, an increase of 299 over the 1,822 members in good standing at the end of March last year. During the fiscal year, 134 members were lost through death, resignation or forfeiture of membership for non-payment of dues.

The membership today is 2,142, as against 2,020 at the date of the Annual General Meeting in 1957.

PROGRAMMES

The Institute's programme for the year has consisted of three two-day meetings and a one-day symposium on Foreign Objects, held in October.

The first of the meetings was the Joint I.A.S./C.A.I. Meeting held in Montreal on the 21st and 22nd October. Its programme included 16 technical papers and a panel discussion on Education and Training; the total registration was 477. It was a very enjoyable affair, as these Joint Meetings always are, and the papers presented were of high quality.

The Mid-season Meeting, held on the 27th and 28th February in Vancouver, was surprisingly successful, considering its distance from the larger Branches and the consequent significance of February weather and current restrictions on travel. The registration was 145, of which 46, nearly one-third, came from the east. The technical programme included 13 papers, one of which was presented at a special session in the evening, tried for the first time – and with great success – on this occasion.

This Annual General Meeting is the third major meeting of the year. Here again a change from previous practice has been introduced. Since its inception, the W. Rupert Turnbull Lecture has been included in the programmes of the I.A.S./C.A.I. Meetings, but it seems to be more appropriate that this, the premier lecture of the Institute, should be delivered at a meeting sponsored exclusively by the C.A.I.; furthermore, the occasion of its delivery might well be elaborated into a special ceremony for the presentation of the Institute's other Honours and Awards. Such a ceremony will, therefore, take place this afternoon before the delivery of the W. Rupert Turnbull Lecture for 1958.

In addition to these Institute meetings, the Branches have held meetings regularly throughout the season. A rough calculation will indicate that, under the Branch and Institute programmes taken together, about 100 technical papers have been delivered in Canada in the last twelve months; this is quite a significant contribution to the dissemination of information.

OTHER SOCIETIES

The Institute's relations with other technical societies are better than they have ever been – and that has always been good.

Grants

It was reported above that the Institute has been able to forego further financial assistance from the R.Ae.S., the I.A.S. and the E.I.C. These three societies had very generously undertaken to make annual grants to the C.A.I. for five years after its formation, to give it a fair chance to establish itself. As a result of the replanning of the Institute's activities and the reassessment of its finances which took place this year, the Council considered that the fifth and final grants were no longer necessary for survival and that, in fact, the status and self-respect of the Institute would be enhanced if the members themselves were to shoulder more of the financial responsibility. Apparently the membership thought so too; for the necessary amendment to the Bylaws was carried with a comfortable margin over the two-thirds majority required.

Needless to say, this gesture of financial independence has been very well received by the three societies. They realize that without their help their offspring might never have got under way at all and they take a parental pride in the C.A.I.'s progress.

Anglo-American Conference

Since 1947, the R.Ae.S. and the I.A.S. have held a series of biennial meetings, alternating between Great Britain and the U.S.A.: the last of this series of Anglo-American Conferences was held in England last year. This distinguished partnership has now invited the C.A.I. to participate in its next Conference, to be held in New York in 1959. The invitation bestows upon the Institute a great compliment and honour, which are most sincerely appreciated. It is understood that the plans may include a one-day visit to Canada and the Institute would be very pleased of such an opportunity to welcome the British and American delegates – even for so short a time – during Canada's 50th Anniversary year.

International Council of the Aeronautical Sciences

Another international event in which the Institute will take part is the First International Congress in the Aeronautical Sciences, which will be held in Madrid next September. Early in 1957, Dr. J. J. Green, the first President of the Institute, was invited to represent Canada in the preliminary planning of this Congress and, as the plans have developed, he has kept the Council fully informed. The C.A.I. has now been formally invited to represent Canadian scientists and engineers on the International Council; and has accepted.

A Canadian paper will be presented at the Madrid Congress and it is hoped that many members of the Institute will be able to attend. The Congress will take place immediately after the S.B.A.C.* Show at Farnborough.

American Rocket Society

There is one other development of note in the Institute's relations with other societies. The C.A.I. was founded to bring together the members of the various aeronautical groups, operating or inoperative, which existed in Canada before 1954, and it has always contended that the country could not support or justify more than one technical society devoted to aeronautics and related subjects. Consequently the above-mentioned Propulsion Section was started, in the pre-Sputnik days, to cover the current interest in the work of the American Rocket Society and to forestall, if possible, the establishment of A.R.S. Sections in Canada. Happily the American Rocket Society proved to be most cooperative; their Council agreed not to set up Sections in Canada in competition with the Institute, to help and advise in the activities of the Propulsion Section, and to enter into an agreement with the Institute, whereby members of either organization could purchase the publications of the other at member rates.

The Council wishes to express its appreciation of this friendly gesture and looks forward to an exchange of speakers, occasional joint meetings and the development of other cooperative projects between the A.R.S. and the C.A.I.

1959

Next year, 1959, will be the 50th Anniversary of Powered Flight in Canada and the Council has laid special plans to celebrate the event; in fact the whole annual programme will be modified to suit the occasion. Firstly there will be no Mid-season Meeting, in the usual sense, but instead a Special Anniversary Meeting will be held in Montreal on the 23rd and 24th February. Although there will be no Mid-season Meeting, the Halifax-Dartmouth Branch will have a chance to show its mettle when the Annual General Meeting for 1959 is held at Keltic Lodge, Ingonish, N.S., on the 15th, 16th and 17th June. Keltic Lodge is quite near Baddeck and the programme will include a visit to that historic site, at which time a quarter-scale model of the Silver Dart, presented by the Institute, will be unveiled. The earlier plan, to build a full-scale model of the Silver Dart, had to be abandoned when it was found that the R.C.A.F. were working on a similar project; this quarter-scale model, in metal and designed to stand out of doors, has taken its place.

During the last few months the Institute has played an active part in the work of the National Coordinating Council for the Golden Anniversary of Flight in Canada. This body, representing practically everybody concerned with Canadian aviation – the Armed Services, the Industry, the Airlines and several organizations such as the Air Cadet League and the Canadian Owners and Pilots Association – has been set up to avoid conflict of the programmes of its respective members and, where possible, to coordinate these programmes into a broad national celebration throughout the year. As its contribution to this national effort, the Institute has invited the National Coordinating Council to hold its monthly meetings in the Institute's Headquarters and has provided office space for its full-time manager, or "Coordinator" as he is called. It should be added that the life of this National Coordinating Council is expected to be about 12 to 18 months, starting last April.

EDUCATION AND TRAINING

In the field of Education and Training, the Council reappointed the six Provincial Committees first set up in 1956-57. These Committees have been left very much to their own devices and have brought influence to bear on education and training problems of all sorts, whenever the opportunity offered.

The Chairmen of these Committees have been Mr. F. L. Hartley in British Columbia, Mr. W. A. B. Saunders in Alberta, Mr. C. M. Hovey in Manitoba, Professor T. R. Loudon in Ontario, Mr. R. H. Guthrie in Quebec and Mr. E. C. Garrard in Nova Scotia. Mr. R. B. McIntyre has served for a second year as the member of the Council primarily responsible for the Institute's education and training interests and he has acted as Chairman of two meetings of representatives of all the Provincial Committees. These meetings were held in Montreal in October and in Ottawa in March and they produced some very stimulating discussion and exchange of ideas between the various Provinces.

The Institute was invited to send a delegate to the Canadian Conference on Education held in Ottawa last February. Fortunately Professor Loudon was able to represent the C.A.I. at this important gathering and he reported his impressions to the meeting of the Provincial Chairmen in March.

In general it might be said that, due to changing conditions in the Industry, the demand for scientists and engineers seems to be eased for the time being, but the demand for the immediately sub-professional levels, the technologists and technicians, is likely to increase as their value and their place in the scheme of things becomes more generally recognized. The promotion of this recognition is one of the Institute's principal objectives – as it has always been.

HONOURS AND AWARDS

As has been stated, the announcement of the appointment of Honorary Fellows and the presentation of the McCurdy Award and the F. W. (Casey) Baldwin Award will take place before the delivery of the W. Rupert Turnbull Lecture this afternoon; but mention should be made of the W. Rupert Turnbull Lecture for 1957, which was delivered by Dr. G. N. Patterson at the I.A.S./C.A.I. Meeting last October. Dr. Patterson's lecture entitled "Aerophysical Problems of Flight at Extreme Altitudes and Speeds", apart from being a very fine lecture, served as a reminder of the high quality work which is being done, here in Canada, at the Institute of Aerophysics under Dr. Patterson's direction.

ELECTION OF FELLOWS

The Council has just completed the election of Fellows for 1958. The nomination and election of Fellows is a grave responsibility, since the prestige of the Institute depends to a great extent upon the stature of those admitted to its highest grade of membership. Each candidate must have been an Associate Fellow for at least one year and he must be nominated by a member of the Council or by four of the existing Fellows. It is then for the Council to decide, by letter ballot, which of these nominees possesses the necessary, very exacting qualifications set out in the Bylaws.

The members admitted to Fellowship this year are:

Mr. R. J. Baker
Mr. S. L. Britton
Mr. F. H. Buller
Mr. I. A. Gray
Mr. R. H. Guthrie
A/V/M M. M. Hendrick
Dr. E. R. Sharp

NEW COUNCIL

At the beginning of yesterday's meeting between the retiring Council and the Council for the coming year, the new Council elected its President and Vice-President. It is a great pleasure to announce the names of the new President and his Council, partly because it introduces a new regime – le roi est mort, vive le roi – and partly because the announcement always arouses far more interest than the foregoing recitation of the events of the past year; such forward-looking is a healthy trait.

These then are the names of the new Council:

President – Dr. G. N. Patterson
Past President – G/C H. R. Foottit
Vice-President – Dr. D. C. MacPhail

Councillors –

Mr. P. B. Dilworth, Toronto
Mr. F. M. Hanna, Toronto
Mr. J. P. Uffen, Toronto
Mr. A. E. Ades, Montreal
Mr. T. A. Harvie, Montreal
Mr. D. Boyd, Montreal
Mr. J. L. Orr, Ottawa
Mr. R. N. McCollum, Vancouver
Mr. L. C. Bryan, Vancouver
Mr. W. E. Robinson, Winnipeg
F/L J. J. Deslauriers, Winnipeg
S/L J. E. Moran, Edmonton
Mr. J. G. Portlock, Edmonton
W/C W. N. Hoye, Cold Lake
Mr. E. K. Prentice, Cold Lake
CDR E. B. Morris, Halifax-Dartmouth
Mr. E. C. Garrard, Halifax-Dartmouth
S/L M. R. Barrett, Calgary
Mr. J. D. Zmurchyk, Calgary

The retiring Council hands on the baton.

Report of the Finance Committee 1957-58

The Institute has enjoyed a successful year financially. As may be seen from the Auditor's Report, Total Income exceeded Total Expenditure by $7,788.14. This surplus, while considerably less than that of prior years, is nevertheless satisfactory when considered in relation to the expanded activities of the Institute and the related increases in staff, enlarged headquarters facilities and necessary capital outlays.

The accumulated surplus account now stands at $47,745.68. Of this sum, $20,000 has been set aside as a Fund for Scholarships and Awards. The remaining $27,745.68 constitutes a Reserve. This Reserve comprises net Liquid Assets of approximately $25,000 and Fixed Assets (at depreciated book value) of roughly $3,000. It should be noted that the $20,000 Fund while arbitrarily set aside for Scholarships and Awards has not been set up as an endowment and can accordingly be considered as additional reserve.

Comparative analyses of Revenue and Expenditures for 1956-57 and 1957-58 reflect several significant changes in respect to the fiscal affairs of the Institute. The principal items worthy of note are:

(1) A drop in Sustaining Membership revenue of about $5,000.

(2) A rise in individual membership revenue of about $2,000.

(3) An increase in remissions to Branches of about $1,000.

(4) A rise in interest derived from investments of about $1,000.

(5) Essentially no change in net revenue derived from Meetings or Publications.

(6) An increase in salary costs of about $3,000 due to an increase in headquarters staff.

(7) An increase in headquarters operating expenses of about $2,000–due to rental of larger space and to increased consumption of operating supplies.

(8) Increased travel expenses of headquarters staff of about $1,000, including visits by the Secretary to the U.K. and to the West Coast.

(9) Increased capital outlay of about $2,000 – primarily in connection with outfitting the new headquarters office.

The combined effect of the above factors results in an overall reduction in Surplus "earnings" of nearly $12,000 as compared with 1956-57.

This significant change in financial operations of the C.A.I. should not be cause for serious alarm. Neither, however, is it a matter for complacency. In prior years a basic objective of fiscal policy has been to build up a healthy operating reserve – roughly equivalent to one year's operating expenses. This objective has not yet been reached, because the expanded scale of operations causes an increase in objective and has not been matched by a corresponding increase in revenue. As previously pointed out, however, the Accumulated Surplus or Reserve Fund has been augmented by a substantial sum during the year while concurrently supporting the expanded scale of activity and expenditure.

Several other matters which occupied the attention of the Finance Committee during the year are worthy of brief comment.

MEMBERSHIP FEE SCHEDULE

With the aim of achieving a more equitable balance between income derived from individual members versus Sustaining Members and to free the C.A.I. from the need for further Grants from the Royal Aeronautical Society, Institute of the Aeronautical Sciences and Engineering Institute of Canada, an increased schedule of fees for individual members was implemented and will become effective in 1958-59.

BUDGETARY CONTROL SYSTEM

A new system of budgetary control was devised and implemented. This takes the form of an annual forecast of income and expenditure in various categories divided into quarterly periods. Actual figures are recorded and compared with the budget forecast at the end of each quarter. This system appears to be both simple and effective and should provide adequate advance warning of trends in either income or expenditure so that appropriate corrective action can be initiated at an early date.

ACCOUNTING RECORDS

The total costs and expenses of meetings are now incorporated into headquarters' accounts. Previously headquarters' accounts and annual statements only reflected the net revenue or deficit from meetings.

As previously referred to, a Fund has been set up for Scholarships and Awards from the Accumulated Surplus Account.

STAFF BENEFITS

Some consideration was given to extending the Retirement Benefit plan to additional members of the staff. The demands of other affairs precluded positive action being taken however and this matter is therefore regretfully passed on to next year's Committee for action.

DRAFT BUDGET FOR 1958-59

Following the practice initiated, I believe by the 1956-57 Finance Committee, a draft budget for 1958-59 has been prepared for the guidance of the incoming Finance Committee, and a word of caution seems appropriate in this regard. During the forthcoming year the Institute will feel the full impact of increased expenditures resulting from its expanded scale of operations. With the benefit of the increased schedule of Membership Fees and allowing for no rise in sustaining membership income, it appears possible to carry out the projected programme for 1958-59 with a balanced budget and possibly even a modest surplus. It should be kept in mind, however, that this will only be possible if the projected revenue from individual and sustaining membership sources is realized. In light of currently unsettled economic conditions, however, this outcome cannot be taken for granted and a close watch should be kept on both expenditure and revenue in the months ahead.

In conclusion, I should like to thank the other members of the Committee for their valued advice and assistance during the year. I am particularly indebted to Mr. Luttman who has carried the lion's share of work on budget forecasts and to Mr. L. D. Clarke for his sage counsel and for his help in respect to legal matters relative to the Staff Retirement Plan.

AUDITORS' REPORT

To the Members,
Canadian Aeronautical Institute,
Ottawa, Ontario.

We have examined the accounting records of the Canadian Aeronautical Institute for the year ended March 31, 1958, but we did not make a detailed examination of all the transactions in the year.

Subject to the foregoing, in our opinion, the following balance sheet and related statement of revenue and expenses have been drawn up so as to show the true and correct view of the financial condition of the Canadian Aeronautical Institute as at March 31, 1958, and of its operations for the year ended on that date, according to the best of our information and the explanations given to us and as shown by the books.

ARMSTRONG, CROSS & CO.,
Chartered Accountants.

OTTAWA, Ontario,
May 13, 1958.

Statement 1

CANADIAN AERONAUTICAL INSTITUTE
BALANCE SHEET
As at March 31, 1958

ASSETS

Current:			
Cash on hand in bank	$24,892.89		
Less: Due to Scholarship Fund	1,743.13		
		$23,149.76	
Accounts receivable		2,250.87	
Hydro Electric Power Commission Bonds 3½% due March 1, 1977		11,970.00	
Accrued interest on bonds		83.75	
			$37,454.38
Fixed:			
Furniture and fixtures		4,391.58	
Less: Accumulated depreciation		1,436.22	
			2,955.36
			$40,409.74

LIABILITIES AND SURPLUS

Liabilities:			
Accounts payable and accrued charges		$ 2,480.06	
Fees received in advance		9,927.00	
Journal subscriptions received in advance		257.00	
			$12,664.06
Surplus:			
Balance—March 31, 1957		39,957,54	
Add: Net revenue for the year—per Statement 2		7,788.14	
		47,745.68	
Deduct: Transferred to Scholarship and Awards funds		20,000.00	
			27,745.68
			$40,409.74

SPECIFIED FUNDS

Due from General fund		$ 1,743.13	
Dominion of Canada bonds—3% due September 1, 1966—at cost		18,256.87	
			$20,000.00
Scholarship fund		18,000.00	
Awards fund		2,000.00	
			$20,000.00

Statement 2

STATEMENT OF REVENUE
For the year ended March 31, 1958

Meetings			$ 9,102.50	
Publications:				
Journal subscriptions		$ 4,934.28		
Advertising		18,831.07		
Sundry technical papers		702.00		
			24,467.35	
Membership:				
Members' dues		9,066.00		
Entrance fees		2,070.00		
Sustaining members		27,370.00		
Grants		2,200.00		
			40,706.00	
Investment:				
Bond interest—Dominion of Canada 3%	$370.89			
—H.E.P.C. 3½%	420.00			
		790.89		
Bank interest		490.89		
			1,281.78	
Miscellaneous:				
Office supplies		314.66		
Lapel pins		436.00		
Christmas cards		44.00		
Staff benefits		383.56		
			1,178.22	
TOTAL REVENUE				$76,735.85
TOTAL EXPENSES—per Statement 3				68,947.71
Net Revenue for the year—to Statement 1				$ 7,788.14

Statement 3

STATEMENT OF EXPENSES
For the year ended March 31, 1958

Meetings:			
Dinners and facilities	$ 7,026.15		
Printing	711.59		
		$ 7,737.74	
Publications:			
Journal	18,151.53		
Sundry technical papers	2,660.61		
List of members	1,002.00		
		21,814.14	
Remissions to Branches and Sections:			
Standard allowances	3,510.00		
Special allowances	64.37		
		3,574.37	
Prizes:			
Awards		304.27	
Membership routine		765.39	
Secretariat:			
Salaries	19,755.85		
Staff benefits	1,032.52		
Part-time help	30.75		
		20,819.12	
Headquarters:			
Rent	3,630.00		
Insurance	28.13		
Telephone and Telegraph	474.11		
General maintenance	38.82		
Office supplies	3,802.16		
Exchange and bank charges	249.89		
Legal and audit fees	470.00		
Miscellaneous	149.52		
		8,842.63	
Travel:			
Headquarters	2,110.21		
Education and training	732.38		
		2,842.59	
Capital Equipment:			
Office improvement	1,808.30		
Provision for depreciation	439.16		
		2,247.46	
Total Expenses—to Statement 2			$68,947.71

Report of the Admissions Committee 1957-58

The Admissions Committee for 1957-58 was reconstituted as recommended by the previous year's Committee and was appointed by the President as follows:

Chairman – G/C C. W. Crossland
Members – Mr. C. D. Long,
Mr. J. C. Finlayson

The Secretary of the Institute also serves as Secretary of the Committee, an arrangement which has transferred considerable administrative work from the Chairman to the Secretary and his capable staff.

Since all members of the Committee are residents of Ottawa, it has been possible to consider applications at meetings instead of by correspondence as formerly. In reconstituting the Admissions Committee, the Council delegated full responsibility to the Committee for admissions, advancements in grade of membership, and determining the eligibility of Student members to remain in that classification.

The new organization and method of work of the Committee has speeded up its work a great deal and the Committee recommends that the present arrangements be continued. The Committee has held fifteen meetings since its reorganization and the number of candidates admitted to the various grades is given in the table below. Last year's figures are given in brackets, for comparison.

	Admitted	Regraded
Associate Fellow	13 (24)	7 (7)
Member	172(263)	26 (18)
Associate	17 (24)	1(nil)
Technical Member	107(151)	19 (11)
Junior Member (Technician)	10 (17)	8 (2)
Student	45(109)	nil(nil)
	364(588)	61 (38)

Seven applications for regrading were not accepted. Eighty applications for admission are awaiting return of reference forms. For the first year, however, there has been a substantial decrease in the number of new members admitted.

The Committee is pleased to note that more members have applied for transfer to a higher grade this year and feels that there are many members who have accumulated sufficient additional experience since their admission to qualify for a higher grade of membership. Such members are urged to apply for advancement when they feel they can meet the qualifications stated in the Bylaws. The Committee would like to stress, however, that admission to the grade of Associate Fellow requires a minimum of ten years actual experience in the practice of aeronautical science or engineering. Time spent in University is not included in the ten years requirement, although credit is given for time spent in study for admission to the lower grades. Experience alone is not sufficient for admission to the grades of Member or Associate Fellow; the other requirements given in the Bylaws must also be met.

It is only by careful selection of candidates that the Committee can establish and preserve the prestige of the Institute in the aviation world. During the year the significance of the Institute's grades of membership has been brought to the attention of the Personnel Managers of all Sustaining Member companies. It is understood that the Department of Labour has also recognized our system of grades.

Report of the Publications Committee 1957-58

The Publications Committee has met three times in the past year, and most of the onerous tasks continue to fall upon the able shoulders of our Secretary and his staff. The Committee also acknowledges the assistance in time and effort of the many self-effacing members who contribute behind the scenes, not overlooking, of course, those who boldly submitted their work for publication. This gratitude is not expressed with a view to sharing responsibility for the criticisms of those who do not approve the course of our Journal. The Committee is not without self-criticism; and it is not without misgivings for the policy to put a regular issue in the hands of such a diverse membership.

As of March 1958, the Journal had a circulation of 2,539 copies, at a production and distribution cost of $18,831.07, thereby creating the argument that if the Journal is an unwanted child, at least it is self-supporting.

There are those who continue to hold that the child should be educated, which is reasonable. The Journal should represent Canada's best, or we should not claim national status for it. But our present policy demands a degree of arts and science; on this we must trade. The Committee has, therefore, to the best of its ability, performed an adagio between the dignity of our academic elite, the brutality of our practitioners, and the avarice of our treasurer. You may think that only the latter is pleased. He is not! Revenue from the sale of preprints and reprints was only $702.00, while the production costs were $2,660.61. This deficit has been technically cleared by calling the transaction "a service to our members".

The Committee's greatest task is to gain the submittal of high calibre papers from brilliant or otherwise accomplished gentlemen – mostly against vague hints of reluctance to pour out fragrance on a desert air. Some of you will no doubt writhe a little at the mention of deserts so closely upon the heels of our recent success in watering the stock. The increase in fees cannot be ascribed solely to the operations of the Journal, which received (at $2.00 per subscription) a total of $4,934.28. In other words, our Journal has some two thousand four hundred and sixty-seven point one four faithful readers. Those who are withholding papers for the want of reading fans, please note!

For some reason, the Publications Committee is charged with the cost of a membership list in the exact amount of $1,002.00. It is well known that the list is used by Mr. Luttman chiefly for mailing notices of membership dues, notices of memberships overdue, and threats. It is the Committee's opinion that if the fees collected in this manner were offset against the cost of the membership list, a profit would be shown.

We have the honour, Mr. President, to submit this report to you, and to invite castigation by any of the members so inclined.

Report of the National Programmes Committee 1957-58

Our technical meetings are the keystone of the Canadian Aeronautical Institute and this represents a heavy responsibility for the Programme Committees (both local and national) in the selection of topics and upon the speakers in presenting their papers. The vigorous progress of aeronautics in Canada has continued and, as a result, there has been no real dearth of subject material or of members wishing to contribute, although at times intensive exploration and cultivation has been necessary. A brief survey of programming activities and some highlights of the national meetings and future plans are presented below.

CURRENT ACTIVITIES

The following is a brief résumé of national meetings during the 1957-58 season.

Joint I.A.S./C.A.I. Meeting

In accordance with established practice, the joint meeting with the Institute of the Aeronautical Sciences took place in Montreal on the 21st and 22nd October, 1957. Sessions included Navigation and Traffic Control, Propulsion, Education and Training, Special Techniques, Airline Operations and Space Vehicles (the latter being very topical in coinciding with Sputnik I!).

Mid-season Meeting

The Mid-season Meeting took place in Vancouver on the 27th and 28th of February and by all accounts was very favourably received. Its success owes a great deal to the efforts of the Vancouver Branch in both planning and execution. The programme included sessions on Test Flying, Operations and Safety, Electrics and Electronics and Inspection and Maintenance. One innovation was an evening session which was very well attended.

Annual General Meeting

The technical sessions to be held in Toronto on the 26th and 27th May include the following topics: Engineering Administration, Production Engineering, Computers, Ground Equipment and STOL/VTOL Aircraft.

It was decided that the W. Rupert Turnbull Lecture was more appropriate to the Annual General Meeting and this year will be presented by a distinguished British aeronautical engineer, Dr. A. E. Russell.

LONG TERM PLANNING

In his report of a year ago, my predecessor pointed out the necessity for forward planning and a serious effort has been made to provide a framework for our successors.

As an aid to future programme planning, the Secretary has made an analysis of previous programmes which has been extremely valuable in ensuring adequate coverage of the many and varied interests of the membership. The dates and places of major Institute meetings have been established up to the end of 1961.

The following is a brief outline of future meetings as presently conceived:

Joint I.A.S./C.A.I. Meeting

This meeting, which will take place in Ottawa next October, will comprise sessions on Aeroelasticity, Aeromedicine, Propulsion, Environmental Testing, Materials and Aircraft Actuating Systems.

Special Anniversary Meeting

The Mid-season Meeting will be replaced by a special meeting in Montreal on the 23rd and 24th February, 1959, on the 50th Anniversary of Flight in Canada. The theme of the programme will be the "Next 50 Years of Flight" and distinguished international aeronautical scientists and engineers will be invited to contribute.

Annual General Meeting

The 1959 Annual General Meeting will take place at Keltic Lodge in Nova Scotia on the 15th, 16th and 17th June and it is hoped the programme will include ceremonies in connection with the unveiling of a memorial at Baddeck.

International Plans

On the international scene, the C.A.I. is sponsoring Canadian participation in the International Congress in the Aeronautical Sciences which takes place in Madrid on the 8th to 13th September, 1958, and it is hoped there will be good representation from Canada.

The next Anglo-American Aeronautical Conference will take place in New York in October of 1959 and the C.A.I. has been officially invited to participate on this occasion for the first time. It is hoped that this conference will include at least one day in Canada for which the C.A.I. would act as host to the visiting delegates.

BRANCH PROGRAMMES

The local Branches, particularly in the more remote parts of the country, frequently request headquarters assistance in obtaining speakers. This presents a number of difficult problems, not the least of which is the maintenance of an up-to-date roster of speakers on topical subjects who are able to travel extensively for this purpose. A step in this direction was inaugurated last year with the provision of visiting speakers to the Winnipeg, Edmonton and Vancouver Branches through the cooperation of the National Aeronautical Establishment.

Basically, the selection of speakers must always rest with the Branch Programmes Chairmen who are in the best position to judge the interests of their membership. However, the national body might help in future by sponsoring a circuit tour by one or two outstanding speakers each year.

SYMPOSIA

In order to broaden its services, the C.A.I. has undertaken to sponsor Symposia devoted to special problems of current interest. The first experiment was a Symposium on "Foreign Objects" which took place in Ottawa on the 24th October last year following the Joint Meeting in Montreal. This was well attended by representatives of operators, manufacturers and the Services and a very useful discussion of the problems and proposed solutions ensued.

It is hoped that this technique can be further exploited in future and suggestions from the members as to suitable topics would be welcome.

COMMITTEE AFFAIRS

The Committee comprises the Programme Chairmen of the various local Branches together with a member of the Council acting as Chairman. Its primary function is programme planning for the national meetings but with the very important task of also assisting and coordinating local activities wherever possible.

The dual obstacles of time and distance have precluded any meetings of this Committee as such, but it is to be hoped that this can be rectified in future, at least to the extent of convening at the first Institute Meeting held after the Annual General Meeting each year.

MEETING ORGANIZATION

The management of our meetings has steadily improved with practice, although there still appears to be some reluctance to curtail the speaker who overruns his time allowance. Our most serious shortcoming, however, is the lack of really critical discussion. This is difficult to accomplish without advance copies of papers and probably requires the assignment of one or two discussion leaders. Nevertheless, we should endeavour to improve the quality of our discussions, which after all is one of the important objectives in presenting papers before a technical audience.

In conclusion, the Committee must pay tribute to the unflagging efforts of the Secretary and his staff upon whom the real burden of meeting arrangements falls. Apart from correspondence, coordination, expediting etc., Charles Luttman has had to make good the shortcomings of the Committee, and whatever success has been achieved over the years is due in no small measure to his personal initiative and hard work.

Report of the Specialist Services Committee 1957-58

The Committee for 1957-58 was constituted as follows:

Mr. R. J. McWilliams–Chairman

Mr. J. Bertalino

Mr. H. D. Cameron

Mr. J. R. S. Hutton

W/C J. W. McNee

The Committee met on several occasions during the year to consider ways and means of providing additional services to specialist interests. Activity centred on three main areas: the establishment of a Technicians Section, the compilation of a Thesis Topics List, and the review of a previous proposal for Student Awards submitted to the 1956-57 Council. Formal proposals covering the last two items were approved in principle at the February 27th, 1958, Council meeting.

Looking back over the year it is regretted that little has been added to the terms of reference for the Committee. Our successors might find it profitable to explore the possibility of working more closely with the Long Range Planning Committee. It is thought possible that the S.S.C. might serve a useful function in the detailed consideration, at the discretion of Council, of certain of the plans of the L.R.P. Committee.

Report of the Long Range Planning Committee 1957-58

As the title indicates, the Committee was set up for the first time this year to provide direction to the C.A.I. Executive and Council in matters concerning the future of the organization.

The Committee was asked to consider the future under the following general headings:

(1) Facilities and organization of the C.A.I.

(2) Objectives and potential

(3) Resulting financial programme

Accordingly, the Chairman was asked to choose experienced members of senior grade and administrative ability to provide the necessary plan of attack. The members asked to act on this committee were Mr. I. M. Hamer and Mr. J. P. Uffen of Toronto and Mr. I. A. Gray of Vancouver to provide the western point of view.

On July 25, 1957, a key meeting was held in Toronto in conjunction with the Finance Committee to discuss C.A.I. forward planning under the following subjects:

(a) Review of existing facilities and staff.

(b) C.A.I. services to the general membership.

(c) Services to Sustaining Members.

(d) C.A.I.'s position in Canada's aviation picture.

(e) Participation in the International Council of the Aeronautical Sciences.

(f) Participation in the preservation of aviation history in Canada.

(g) Increasing independence of the C.A.I.

As requested by Council, the Committee came up with recommendations with regard to the inadequacy of the facilities and staff of the C.A.I. Headquarters, after careful consideration of the potential growth of the Institute and meeting the ever increasing load of the Secretary. Mr. Luttman was directed by Council to seek larger and more suitable quarters within the same building, to acquire the additional equipment necessary for the office, and to retain the services of an Assistant Secretary. It should be noted that all of the foregoing has been carried out with a noticeable improvement in the operations.

On the subject of C.A.I. services to the general membership, recommendations were suggested to Council on many ways in which improvement could be made to existing services. Some of the more important recommendations involve the support of specialist Sections and the offer of additional facilities to setting up and operating independent meetings through the local Branches; planned speaker programmes to cover the more remote sections and additional support by Headquarters to cover the expenses of expert speakers in special circumstances. It was also suggested that more effort should be made to have facilities and aid given to members in the preparation and presentation of papers. As the principle of Awards had already been agreed to by the Institute, it was recommended that provision should be made to cover

scholarships, bursaries and post graduate assistance at all academic levels. The charts outlining the growth of the C.A.I., which are part of a published document mentioned below, indicate the inclusion of funds required for the support of the recommendations mentioned over the period of the next five years.

On the matter of services to Sustaining Members, it is fair to indicate that the primary interest of the Sustaining Members is that the C.A.I. should foster a lively and healthy engineering body in Canada to improve the standard of technical manpower in Canadian aviation. The Sustaining Members themselves were not particularly interested in direct service from the C.A.I. but it was felt that they should be kept abreast of our activities pertaining to industry. The recommendation that a document should be produced to provide information on the growth and planning of the C.A.I. was heartily endorsed by the Council and the Long Range Planning Committee was asked to provide the basic information from which a report could be sent to industry. This document, which indicated the growth of the C.A.I. with regard to the effort to be expended, the planned growth of membership, the planned annual expenditure and the immediate income requirements to the end of the year 1962, was published during the fall and released to all Sustaining Members.

The C.A.I. is actively participating in the activities of the International Council of the Aeronautical Sciences by way of Dr. J. J. Green, now resident in the U.S. and a former President of the C.A.I. This world wide organization, which is presently in the initial stages of formation, will demand more C.A.I. participation and support in the future and will undoubtedly be reported upon in more detail.

With regard to the Institute's activity in matters of historical significance it was considered that, at least within the next five years, the Institute should confine its activities to the support and participation in the work of the Associate Committee for a National Aviation Museum of which the Secretary is already a member.

Finally, a recommendation was put forward to the Council that, in view of the forecast and the optimistic future of the organization, we should inform the R.Ae.S. and the I.A.S. that their yearly support has been very much appreciated and we are now in a position to carry on as a completely self sufficient Canadian organization.

It is recommended that this Committee be maintained to keep a watching brief on the overall objectives and future planning of the organization. It is felt that by the publication of statistical documents indicating the plans to the general membership and Sustaining Members, a more lively interest in the organization will be sustained.

Report of the 50th Anniversary Committee 1957-58

The two main events scheduled for the C.A.I. to commemorate the 50th Anniversary of Powered Flight in Canada are:

(1) A Special Spring Meeting to be held in the Queen Elizabeth Hotel, Montreal, on the 23rd February, 1959. This date coincides with the date of the first flight by J. A. D. McCurdy.

(2) Annual General Meeting to be held at Keltic Lodge, Ingonish, N.S., on the 15th, 16th and 17th June, 1959. Keltic Lodge is about 50 miles from Baddeck, N.S., where the first flight took place, and it is planned to spend one of the days of the meeting at Baddeck where a model of the Silver Dart will be unveiled.

The Committee recommends that care be taken to refer to it as the Committee of the 50th Anniversary of Powered Flight in Canada, to prevent any confusion with any committee of the National Coordinating Council for the Golden Anniversary of Flight in Canada, of which the C.A.I. is an active member. It should also be stressed that what we are trying to do is honour the work of the Aerial Experiment Association rather than just the flight of McCurdy.

We had hoped to have our Patron, H.R.H. The Prince Philip, attend the meeting in February but at the moment this appears unlikely. The Secretary is doing his usual good job and the plans for this meeting are going ahead on schedule. The problem of getting into the exhibition business at such meetings has come up. It is believed that we might try this out at this meeting. It has become standard practice to have such exhibitions at meetings of professional societies and if well handled can be a source of revenue to the society with no effort on their part.

No definite plans for the meeting in Nova Scotia other than the reserving of Keltic Lodge have been made; as for the ceremony at Baddeck, the proposal is that a one-quarter scale model of the Silver Dart be constructed in aluminum and placed on a pedestal in the Lagoon, a lake situated in the grounds of the Alexander Graham Bell Museum. The estimates of the cost of the model and other incidental expenses will probably be about $3,000.

The Nova Scotia Travel Bureau and the Baddeck Board of Trade are being very cooperative. The Armed Forces have indicated that they are also willing to assist and it is possible that a large fly-past could be arranged at the time of the unveiling.

JOINT I.A.S./C.A.I. MEETING

Programme

October 7th Morning 9.00 a.m.

AEROMEDICINE

Chairman
G/C W. R. Franks
Scientific Advisor
Institute of Aviation Medicine, RCAF

The Design of Training Equipment
Dr. C. Seitz
Chief Human Engineer
Grumman Aircraft Engineering Corp.

Functional Mockups for Aircrew
Dr. M. G. Whillans
Assistant Chief Scientist and Director Biosciences Research
Defence Research Board

Recent Studies of Human Requirements in Hypersonic Escape
Dr. A. W. Hetherington
Technical Director
Directorate of Life Sciences, ARDC, USAF

AEROELASTICITY

Chairman
B. J. Kaganov
Director, Research and Advanced Development
Canadair Limited

The Use of Models in Aeroelastic Analysis
J. McKillop
Chief of Aeroelasticity
Avro Aircraft Limited

The Flutter of Low Aspect Ratio Wings
W. Targoff
Head, Aero Mechanics Dept.
R. P. White, Jr.
Head, Aeroelasticity Sect.
Cornell Aeronautical Laboratory, Inc.

The Aeroelastics of Tall Stacks
Professor R. A. Boorne
Director of Engineering
Mount Allison University

Afternoon 2.00 p.m.

PROPULSION

Chairman
R. M. Sachs
Chief Design Analysis Engineer
Orenda Engines Limited

Design and Applications of Mach 4 Turbine Engines
M. A. Zipkin
Manager, Advanced Propulsion Systems
R. E. Neitzel
Critical Problems Engineer
Flight Propulsion Laboratory Department
General Electric Company

Rocket Propulsion in Canada
R. F. Wilkinson
Superintendent, Explosives Wing
Canadian Armament Research and Development Establishment

Powerplant Design Considerations for VTOL Jet Transports
M. J. Saari
Rocket Branch
Lewis Flight Propulsion Laboratory, NACA

ENVIRONMENTAL TESTING

Chairman
G/C R. M. Aldwinckle
Director
Instrument and Electrical Engineering, RCAF

Environmental Simulation, Its Meaning and Value in System Testing
C. A. Mills
Section Engineer, Environmental and Appraisal Laboratory
Electronics Division
Canadian Westinghouse Co. Ltd.

The Ordnance Corps Envanal System
H. M. Bunch
Sr. Research Engineer, Environmental Research Sect.
Southwest Research Institute

Operational Value of Test Specifications
E. B. Moss
Director of Engineering and Manufacturing
Canadian Applied Research Limited

Evening 7.00 p.m.

DINNER

Chairman
Dr. G. N. Patterson
President, Canadian Aeronautical Institute
Director, Institute of Aerophysics

Principal Speaker
E. R. Quesada
Chairman
U.S. Airways Modernization Board

October 8th Morning 9.00 a.m.

AIRCRAFT ACTUATING SYSTEMS

Chairman
D. R. Taylor
Director, Engineering Products Division
Aviation Electric Limited

Pneumatic Actuating System for 1000°F Operation
J. A. Osterman
Group Engineer i/c of Advanced Systems Research
Lockheed Aircraft Corp., Georgia Division

Design of Hydraulic Systems for High Speed Aircraft
D. Royston
Senior Systems Engineer
Avro Aircraft Limited

The Role of Electrical Actuating Systems in Supplementing Sea Master Flight Controls
H. C. Zachmann
Staff Engineer — Electrical
The Martin Company, Baltimore Division

MATERIALS

Chairman
R. Smallman-Tew
Chief Metallurgist
Avro Aircraft Limited

Close Tolerance and Other Special Forgings
W. Morgan
Vice-President, Research and Metallurgy
Canadian Steel Improvement Ltd.

Thermal Insulation Ceramic Coatings
A. V. Levy
Supervisor, Material & Process Section
Marquardt Aircraft Co.

Ultra High Strength Steels
W. B. Mackay
Research and Development Engineer
Atlas Steels Limited

Afternoon 2.00 p.m.

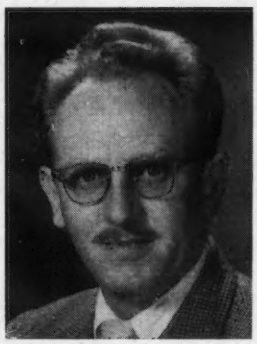
TEST FLYING

Chairman
E. L. Bunnell
Chief Test Pilot
Bristol Aircraft (Western) Ltd.

Broad Outline of Aircraft Feel: Pilot's Appreciation
W. J. Potocki
Experimental Test Pilot
Avro Aircraft Limited

Piloting Research Aircraft
J. A. Walker
Chief Test Pilot
NACA High Speed Flight Station, Edwards AFB

SOME OF THE SPEAKERS



Dr. C. Seitz

Dr. M. G. Whillans

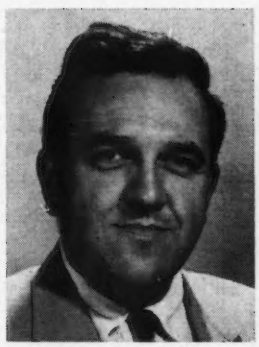
Mr. J. McKillop

Mr. W. Targoff

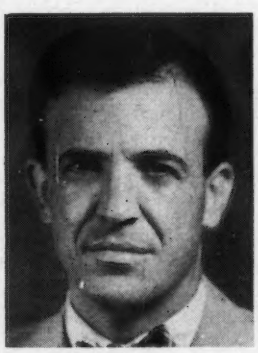
Mr. R. P. White

Prof. R. A. Boorne

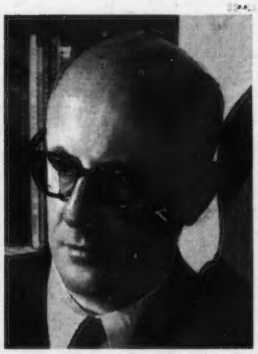
Mr. R. F. Wilkinson



Mr. C. A. Mills



Mr. H. M. Bunch

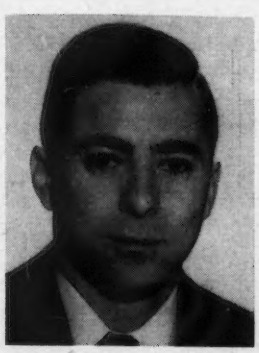


Mr. E. B. Moss

Mr. J. A. Osterman

Mr. H. C. Zachmann

Mr. W. Morgan



Mr. A. V. Levy

Mr. J. A. Walker

JOINT I.A.S./C.A.I. MEETING

JOINT IAS/CAI MEETING

NOTICES giving the full programme of the Joint IAS/CAI Meeting have been sent to all members of the Institute; the programme is also set out on the preceding page.

ABSTRACTS

The following are abstracts of some of the papers to be presented at the Joint IAS/CAI Meeting.

The Design of Training Equipment

Dr. C. Seitz–Grumman Aircraft

This paper will show that an efficient way to assure appropriate training support for a weapon system is to start planning for training support parallel with planning for the operational equipment itself.

A training system analysis, undertaken at this time, will provide the information essential to a determination of critical training tasks, an indication of those that are trainable, and a statement of contingencies to be provided.

The kinds of training aids and the limitations of all purpose trainers will also be discussed.

Slides and a short film will be used.

Functional Mockups for Aircrew

Dr. M. G. Whillans–DRB

The advantages which could derive from functional mockup studies have largely been ignored. Such studies have been few, have rarely been related to a specific aircraft, and have almost never taken full account of the combination of physiological and psychological effects of the aircraft environment and of the work during typical mission times.

Such mockup studies, commenced as early in the design process as feasible, should lead to considerable improvements in work environment and work layouts, and to an increase in safety and in passenger comfort. An important further benefit should be more specific guidance in selecting projects for human factors research and development.

The Use of Models in Aeroelastic Analysis

J. McKillop–Avro Aircraft

The influence of aeroelasticity on modern aircraft design is outlined together with the requirement for aeroelastic data which cannot be obtained from analysis. The development of experimental methods to supplement analytical work is reviewed and some examples presented. The theory of aeroelastic model design is briefly treated and the types of models required for different applications are discussed. Model construction, instrumentation and test techniques are presented and some conclusions are derived regarding the role played by aeroelastic models in the design process.

The Flutter of Low Aspect Ratio Wings

W. Targoff and R. P. White
– Cornell Aero. Lab.

This paper presents a practical procedure by which the approximate theory of Lawrence and Gerber can be used to calculate the unsteady pressure distribution on a low aspect ratio wing with a straight trailing edge. The matrix method developed is ideally suited to the determination of the aerodynamic energy associated with a fluttering wing. As an example, the procedure is applied to the case of a 60° delta wing oscillating in an incompressible air stream. The resulting aerodynamic forces are combined with the equations of motion of the vibrating wing to calculate its flutter characteristics. These calculated flutter characteristics are compared with theoretical results obtained using the zero aspect ratio theory developed by Jones. Limited comparison with experimental data is also made.

The Aeroelastics of Tall Stacks

R. A. Boorne–Mt. Allison University

The phenomenon of lateral stack vibrations in a steady wind is examined under the following headings: (a) aerodynamic considerations, (b) structural considerations, (c) preventative measures.

Under (a) an outline is given of the generally accepted theory concerning the origin, amplitude and frequency of the oscillating aerodynamic forces. The limitations of this theory are discussed with reference to several recorded cases of stack vibrations.

Under (b) a method is presented for the determination of the natural frequencies and model shapes of stacks in still air, with or without supporting guy-wires. The analysis is then extended to a study of the behaviour of the structure in moving air.

Under (c) various devices are considered for the prevention of stack vibrations including spoilers, dampers and guy-wires.

Design and Applications of Mach 4 Turbine Engines

M. A. Zipkin and R. E. Neitzel
– General Electric

The performance of turbine engines designed to power self-accelerating Mach 4 vehicles is considered in this paper. Engine performance requirements are shown in relation to the mission with particular attention paid to the acceleration of the vehicle. A straight Mach 4 turbojet engine is described and the factors involved in the selection of the cycle are presented. A turbojet-ramjet engine (dual cycle) which would be based on an existing Mach 3 turbojet is also described and then compared with the straight turbojet. The application of Mach 4 turbine engines to missiles and manned aircraft, and for the first stage boost of ballistic, glide or orbital systems, is examined and the features which make the turbine engine powered vehicles attractive are discussed.

Rocket Propulsion in Canada

R. F. Wilkinson–CARDE

Some of the factors which have influenced the lines of the Canadian rocket propulsion research programme are discussed. The position of the rocket engine in relation to other propulsion devices is briefly indicated and the basic parameters governing rocket engine performance are given. A programme of applied research on case-bondable elastomeric propellants based on ammonium perchlorate and polymerizable fuel binder is described. Three rocket engines are being used, the largest being 17 inches in diameter and 17 feet long. The latter engine will form the basis of a test vehicle for studying propellants and also for use as a high altitude research vehicle. Some comments are made on possible advanced systems which may be considered for space missions.

Environmental Simulation, Its Meaning and Value in System Testing

C. A. Mills–Can. Westinghouse

The paper draws a comparison between the benefits of design testing equipment by investigating each environment in turn with the benefits of flight simulation where the test samples are exposed to more than one environment at a time. The factor that the two test procedures are complementary rather than alternatives is brought out. The benefits to be drawn from each type of

testing are stated together with brief illustrations of the various phases of environmental testing. The danger of too complex a test procedure at an early phase in the design testing is stressed. The value of environmental simulation in the development of equipment for current airborne applications and future airborne applications is stated.

The Ordnance Corps Envanal System

H. M. Bunch–Southwest Research

This system is the program for recording of data reflecting the performance of Ordnance equipment and materiel and for comparative presentation of such data so as to indicate performance limitations under various world-wide environmental conditions; thereby insuring selection of the most suitable standard and special equipment for use in any given operational area.

Operations research analyses indicate that the Envanal charts will (1) provide equipment performance guides to staff planners, (2) serve as a ready reference for future program planning, (3) facilitate liaison between equipment design and testing agencies, (4) aid in checking performance of production equipment, and (5) aid in establishing priority on component testing.

Pneumatic Actuating Sytem for 1000°F Operation

J. A. Osterman–Lockheed Aircraft

In the early part of 1956, the Georgia Division of Lockheed Aircraft Corp., under contract with Wright Air Development Center, embarked upon a study program to evaluate pneumatics as a means of powering high temperature aircraft actuating systems. This program was aimed at determining the feasibility of pneumatics for such a purpose and making recommendations for further work in this field. Based on these results, the program was expanded to include the design and test of a 5000 psi, 1000°F pneumatic actuating system, which has been under test for several months. This paper briefly describes this program.

Design of Hydraulic Systems for High Speed Aircraft

D. P. Royston – Avro Aircraft

Numerous articles and papers have been written expounding the merits of pneumatics, electrics and hydraulics as power supplies for operating aircraft controls and services. The only unanimous conclusion is that each application must be judged on its own requirements.

This is done for a supersonic, all-weather interceptor. Hydraulics are chosen to operate the flight controls and utility services.

Some of the design problems involved are discussed and some comments made on the future of hydraulic systems for airborne use.

The Role of Electrical Actuating Systems in Supplementing Sea Master Flight Controls

H. C. Zachmann–Martin

The basic Sea Master controls system is described and reference is made to the independent hydraulic systems, driven by the engines or electric motors. Detailed attention is placed on artificial feel control devices using electro-mechanical actuators, including the types of electrical power chosen for the various functions and the various mechanical mechanisms employed for safety of flight considerations.

The use of warning devices, such as "Q" System Failure Warning and Flap Position Warning, is explained along with the details of the basic "Q" System as applied to the stabilizer and spoiler controls. The Stall Warning System is also covered.

Additional items not directly connected with flight controls but still a part of the control system, such as Spray Flap and Hydro Flap Systems, are discussed. Throughout its length the paper points out the use of electrical devices and the steps taken to insure utmost reliability to guard against inadvertent operation or failure.

Close Tolerance and Other Special Forgings

W. Morgan–Can. Steel Improvement

The paper outlines the problems involved in the manufacture of close tolerance forgings from the point of view of dimensional limitations and design restrictions. Illustrations are provided showing the type of component which can be produced to precision tolerances by the use of normal dies and by the split die technique. The comments are amplified to indicate the influence of the choice of material on design factors and on processing techniques required. Some thought is given to the trends in the use of precision forgings and to the use of ancillary processes in their production.

Thermal Insulation Ceramic Coatings

A. V. Levy–Marquardt Aircraft

An unclassified, non-proprietary, discussion of the types and uses of thermal insulating ceramic coatings. Both flame-sprayed and reinforced ceramics will be reviewed. The properties of the coatings and the general requirements for their use on sheet metal structures will be discussed.

Broad Outline of Aircraft Feel: Pilot's Appreciation

W. J. Potocki–Avro Aircraft

The introduction of power controlled aircraft enabled the designer to tackle the problems associated with aircraft feel through a range of different methods. In order to keep abreast of this rapidly expanding branch of engineering it is necessary for the pilot to understand the factors affecting aircraft feel and the broad principles underlying some of the generally used design solutions in this field.

A consolidation of these is made with the object of providing an easy reference for the pilots who may wish to know more about "the other man's aircraft".

BRANCHES

NEWS

Montreal

Reported by F. M. Francis

April Meeting

The April meeting of the Montreal Branch was held in the Airlines Cafeteria of the ICAO Building on the 16th April, with 126 members and guests attending. An unusual feature of this meeting was the fact that, in lieu of a regular dinner meeting, the talks preceded a buffet supper which seemed to please all concerned.

The topic for the evening was "Development Problems of the Canadair Argus". Two speakers, Messrs. I. Finkelstein, Section Chief, Electrical Engineering, and S. J. Pope, formerly Chief Development Engineer, now CL-66 Project Engineer, Canadair Ltd., described the problems associated with the electrical system development and aerodynamic development respectively.

In his talk, Mr. Finkelstein pointed out that just prior to World War II airplanes of the DC-3 Canso size had electrical systems producing 3,600 to 4,500 w. In contrast, the Argus electrical system produces 160,000 w which supplies over 80 sub-systems in the airplane. Essentially, the system power source consists of four constant frequency, fully paralleled alternators with the following characteristics: 160 KVA, 115/200 V, 400 cps. Each of the four machines is driven from an engine mounted constant-speed unit which hydraulically controls the input speed to each machine within 15 rpm of 6,000 rpm over a wide range of engine speeds.

Mr. Finkelstein explained that, because of the novelty of a fully paralleled system of this size, Canadair had found it necessary to construct a complete electrical system test bed, which, in effect, duplicated to full scale the entire electrical system.

Mr. Finkelstein closed his talk with a lucid description of the system's fault protection provisions.

Mr. Pope's talk concerned primarily an account of the Argus low-speed wind tunnel program. He described in detail the manner in which a convertible wind tunnel model was constructed so that with a minimum of effort the model could be progressively transformed from a Britannia 100 configuration to the Argus configuration. The speaker described how a 1/18th scale unpowered model had been selected for use in the No. 3 low-speed tunnel at the NAE.

A review of the design and manufacture of the model then followed and a large number of slides were used to illustrate the points. Attention was drawn to the novel manufacturing processes that were evolved for the model during the program.

Mr. Pope then described the four types of testing undertaken. These were six component force and moment measurements, flow visualization, pressure distribution and the jettisoning of stores.

In addition to numerous slides, two short films covering jettisoning tests for the wing pylon mounted rocket pods and jettisoning tests of a large auxiliary fuel tank from the bomb bay were shown.

Mr. Pope paid tribute to Mr. K. W. Kimber whose incentive and leadership as head of the model design and testing team contributed so much to the success of the Argus model program.

W/C C. R. Thompson thanked both speakers.

May Meeting

The annual business meeting of the Montreal Branch was held in the Airlines Cafeteria of the ICAO Building on the 21st May.

Reports on the year's activities were presented by Messrs. K. H. Sullivan, Treasurer, R. J. Conrath, Councillor, F. C. Phillips, Program Chairman, and F. M. Francis, Secretary.

Mr. E. H. Higgins, outgoing Chairman, gave a comprehensive report of his year in office. He paid special tribute to the Chairmen and members of the various special committees who had been most active during this period. Mr. Higgins referred to our perennial problem at the Montreal Branch, namely a large membership but a constantly low percentage turnout to regular meetings, and suggested that perhaps in this area the new executive might try additional experimentation in the place, time and subject of meetings.

Mr. Higgins then introduced the members of the Branch Executive for the year 1958-59.

The new Chairman, W/C C. R. Thompson, thanked the members of the outgoing executive and expressed his appreciation to the assembled members on behalf of himself and the newly elected executive.

To round out the evening, a film was shown of typical transportation difficulties encountered in Canada's north country. The film, compiled by NRC from many sources, graphically demonstrated the need for practical VTOL airplanes in the north. Mr. P. J. Pocock of NAE was kind enough to make the film available for this showing.

Cold Lake

Reported by F/L L. S. Lumsdaine

May Meeting

The annual general meeting of the Cold Lake Branch was held at 2000 hrs on the 20th May in the Sergeants' Mess Library. The retiring Chairman, W/C R. D. H. Ellis, presented the annual report and explained the necessity for electing a new Chairman for 1958-59 in lieu of S/L L. H. Keelan who had been transferred since the Branch elections. F/L L. S. Lumsdaine, retiring Secretary, was elected as Chairman. He proposed a vote of thanks to the retiring committee and introduced the evening's speaker, Mr. C. Oddson of Canadair Ltd. Mr. Oddson gave an interesting talk on the Argus, including the trials which have been carried out so far. Suggestions were then made for the winter program, S/L W. J. Buchan being elected Program Chairman. The meeting adjourned at 2230 hrs.

Halifax-Dartmouth

Reported by Lt. J. A. Turner

May Meeting

The Halifax-Dartmouth Branch held its regular monthly meeting in the cinema of the CPO's Mess, HMCS Shearwater, on Wednesday, 21st May. A total of twenty-two members and guests were present.

In the absence of the Chairman, CPO R. L. S. Sabourin, Mr. R. Wallworth took the chair.

The feature of the meeting was a paper given by Mr. J. A. Lenahan, the Acting Regional Director of Air Services, Dept. of Transport, on the subject "Weather Aids to Aviation". In his talk, Mr. Lenahan analyzed the methods used by the forecaster in his endeavour to give aircrews a picture of the weather hazards they might be expected to encounter. The speaker outlined the difficulties facing the forecaster in attempting to apply the well-known equations of motion to weather and how the variability of the local weather pattern makes mathematical accuracy impossible at the moment. However, with the

advent of electronic computers and high altitude observations, it was reasonable to expect an even greater degree of accuracy in weather prediction for the future.

There was a stimulating discussion following the lecture in which several members related experiences in which weather had played an important part.

The speaker was thanked by Mr. Millar of the Naval Research Establishment.

Ottawa

Reported by H. H. Kelland

June Meeting

The Ottawa Branch concluded its 1957-58 season on Saturday, June 7th, with a combined field trip and family outing to RCAF Air Defence Command Stn. Foymount, Ont. For the some 130 persons who attended, including over 40 Branch members, the technical interest of the tour of the Station combined with the outstanding hospitality bestowed on the party by the Air Force personnel there made the occasion one that will long be remembered by those who attended.

With pleasant weather prevailing, the late spring drive up the Ottawa Valley was most enjoyable. Upon arrival at the Station, members and their families were directed to the combined mess building for lunch. Following a very delicious lunch, the party was divided into two groups with the ladies and children being taken under the able and gracious care of W.D. officers and girls to enjoy the recreation facilities of the Station while the members toured the operations and domestic sites. The ladies were invited to accompany their husbands on the technical tour and many did.

Gathering first in the operations room, the group was officially welcomed by S/L H. A. Pattinson on behalf of the Commanding Officer. Following a brief outline of the Station's organization and operation and its function within the air defence network by S/L Pattinson, the group was guided with great detail through the technical installations and shown other Station facilities.

On completion of the tour the party regathered in the Officers' Mess for refreshments and a buffet supper. While many families found it necessary to return early to Ottawa, others were able to remain on into the evening hours to talk with friends and to join in the Station's social life.

Winnipeg

Reported by D. A. Newey

June Meeting

A meeting of the Winnipeg Branch was held in the Westinghouse Auditorium on the 24th June at which 26 members and 8 guests were present.

Mr. E. L. Bunnell, Chairman, first outlined to the membership the composition of the new Committee, and the names of the newly appointed sub-committee Chairmen. He then introduced the speaker of the evening, Mr. C. H. Glenn, Aircraft Evaluation Engineer, Trans-Canada Air Lines.

Mr. Glenn spoke on the subject "Will we be able to Operate a Turbo Jet Transport Economically". He hastened to explain that while his subject would naturally be closely related to TCA's plans, he believed that the question which was being asked covered the operation of turbo jet transports in general by the entire airline industry. He explained that he was limiting his address to the operation of an airplane as distinct from the operation of an airline, and went on to say that his studies of the subject convinced him that the opinions expressed in a previous address to the Branch in October, 1955, were still basically unchanged – that the turbo jet is a sound economic proposition; just how sound will be dependent upon the individual airline and how the airplanes are flown. He suggested that the title of his talk should really be "How to Make Money with the Jet Transport by not Spending it".

He pointed out that if we disregard items which are not affected by flying technique, we find that fuel will make up about 50% of the actual flying cost. As compared with other machines doing useful work, the turbo jet engine is quite inefficient, although the airplane itself shares some of the responsibility for high fuel consumption. A curve showing the relationship between airplane drag and speed could, for practical purposes, be considered as a curve of fuel consumption against speed. He produced a chart to show that an increase of speed of 10% in the region of 0.8 Mach number would increase fuel consumption by 50%. This results from the effects of compressibility since some components of the wing and airframe are at, or above, the speed of sound. Therefore, the airline must approach the problem of achieving the most economical cruise techniques even where these may involve somewhat lower speed.

There are many variables to be considered in deciding on a cruise technique for a particular operation, all of which affect the cost of operation, range and payload. Some of these are speed, temperature, altitude, wind, aircraft weight, price of fuel etc.

By the use of charts, Mr. Glenn then went on to demonstrate and assess the effect of some of these variables, using as an example an airplane operating at standard temperatures and uniform altitude, landing weight and range etc.

Mr. Glenn pointed out that there are fundamental differences in the approach to cruise and operating techniques for a drag limited airplane (one which normally flies at the point of increased drag with the engine running at less than maximum cruise rating) and the thrust limited airplane (one capable of greater speed than the engine can pro-

Members of the Ottawa Branch at RCAF Station Foymount: (l to r) Mr. H. H. Kelland, W/C W. M. Diggle, Mr. H. C. Luttman, W/C E. E. McCullough, Mr. J. L. Bush, G/C H. R. Foottit, S/L H. A. Pattinson, G/C W. P. Gouin and W/C R. F. E. Kempster

duce). In the first, maximum advantage can be taken of reduced flying time in maintenance and flight operational costs by operating at maximum airplane performance under any conditions for corresponding economical fuel consumption.

Since the speed of sound is dependent on temperature, and since the Mach number is the ratio to the speed of sound, it follows that when given a cruising Mach number the higher the temperature the higher the true air speed. Improving performance due to higher temperatures can be used to permit higher speeds for the same operating cost, or lower costs for the same or slightly higher speeds.

Since timetables are based on standard temperature, little would be gained by cruising at higher speeds since this could not be regularly scheduled. A smart operator will take advantage of a reduction in operating cost and "put this in the bank" against the time when reduction in temperature has an adverse effect on the cost – what he saves in the summer, he stands to lose in the winter.

Altitude also has a very marked effect on flying. Between 30,000 and 35,000 ft there is an increase in cost of about 1% per thousand feet of reduction in altitude. The effect of wind on operating costs indicates that there would apparently be no advantage economically in speeding up when flying against a head wind.

The weight of the airplane, particularly landing weight, is another significant factor in operating costs; extra fuel carried above operating requirements is a factor in this cost.

Of major importance is the price of fuel, where one or two cents a gallon will seriously affect the economics. This is also related to type of fuel, where different types of fuel will give better operating efficiency within different ranges of payloads. Mr. Glenn illustrated the difference which could be encountered between JP-4 and Kerosene.

There was also a limit to the altitude in which it was practical to fly, regardless of the principle that higher operation is in general more economical.

It becomes necessary to maintain speed and altitude in balance between the factors of acceptable controllability at drag divergence. There is an appropriate point in the intersection of these curves which represents the most efficient condition. This would be a variable condition on any long flight due to reduction in weight due to fuel consumption. However, operating conditions in congested traffic will call for operation at constant altitude where some efficiency might be lost. For that reason, TCA had selected an engine which would allow them to fly at constant altitude as economically as possible.

Mr. Glenn summarized many variables which could be considered in deciding on a cruising technique for a particular flight. All of these factors affect the operating costs and, in many cases, payload and range.

One of the answers to solving the detail complex problems which will most certainly arise in this area will be the use of electronic computers, which would make it possible for the Flight Operations staff to select most favourable conditions under constantly varying factors. This additional requirement makes the problem of the operation of aircraft by comparatively small operators very difficult. However, a medium sized operator with average pilots and a reasonable amount of sense could probably show moderate profit, providing sufficient and reliable meteorological data is available.

SECTIONS

ASTRONAUTICS

There have been important developments in the Astronautics Section since it was last mentioned in the April issue of the Journal. The new Council, when it took office in May, approved the establishment of the Section and the President appointed an Interim Committee, comprising Mr. W. F. Campbell, Mr. J. G. LaBerge and Mr. J. A. van der Bliek, to work out the terms of the Section's Regulations and other preliminary details.

After its first meeting, the Committee sent a circular letter to a number of members likely to be interested in the subject, setting out its proposals for the scope and aims of the Section and inviting comments and suggestions. Many of the replies were very helpful and those who said that they would like to be members (there were about 40) were regarded as the initial membership of the Section. An election to determine the first Executive Committee is now in progress.

Qualifications for Membership

At a meeting of the Executive Committee of the Council, held on the 14th August, the Section Regulations drafted by the Interim Committee were approved. These Regulations define the membership of the Section as follows:

> All members of the Institute who are or have been engaged in technical work related to guided flight or space vehicles or who possess technical knowledge of the science and engineering of astronautics shall be eligible for membership of the Section.

This is known as the "Identifying Qualification". Any member of the CAI who considers that he meets these requirements is invited to apply for membership of the Section. No additional dues are required; it is a simple matter of enrolment. Members of the Section are placed on the Section's mailing list and are entitled to vote in its affairs, and thereby exercise some influence on its policy and activities.

Spheres of Interest

The Section Regulations set out the Object of the Section in very broad terms–"technical subjects pertaining to astronautics"–to embrace a wide range of interests. For example, and by no means exhaustively, these interests would include

(a) Gasdynamics and aerodynamics at extreme altitude and speed
(b) Upper atmosphere research: cosmic radiation, physics of gases etc.
(c) Astronomy: physical conditions in space, other planets etc.
(d) Mechanics: ballistics, celestial mechanics
(e) Relativity
(f) Propulsion (in cooperation with the Propulsion Section): rockets, fuels, nuclear propulsion etc.
(g) Guidance and control
(h) Astroelectronics
(i) Space medicine: acceleration effects, weightlessness, radiation etc.
(j) Materials

First Meeting

In common with other Sections, the Astronautics Section will occasionally sponor sessions at Institute meetings and particularly at the Institute's Annual General Meeting. Its Groups in the various Branches may also be called upon to provide speakers in the Branch programmes. However, it proposes to hold a Section meeting of its own in Ottawa on the 9th October, the day following the

IAS/CAI meeting. This meeting is open to all members of the Institute and notices giving the details have been generally distributed.

Canadian Astronautical Societies

Mention should be made of two Societies, both calling themselves the Canadian Astronautical Society, which have recently been formed in Toronto and Montreal. The Astronautics Section of the CAI is quite separate. The Institute has held discussions with both Societies to explore the possibilities of some form of affiliation, but the aims and activities of the three groups seem to be irreconcilable. The Astronautics Section will provide a point of contact and a channel for cooperation with the two Societies, without the restrictions which any type of affiliation would impose.

PRODUCTION

Steps are being taken to organize a Production Section. Discussions have been going on for some months between a group of members at Avro Aircraft Ltd. and the Secretary. Unfortunately, at the time of going to press with this issue of the Journal, it would be premature to publish the aims of the Section or the qualifications necessary for Section membership.

However, members who are interested should get in touch with

Mr. H. J. Reeve,
286 West Broadway,
Orangeville, Ontario.

who has agreed to serve as "Interim Secretary".

MEMBERS

NEWS

E. H. Higgins, F.C.A.I., has been appointed Chief Engineer (Aircraft) and Deputy to the Vice-President (Engineering), Canadair Ltd.

Dr. G. N. Patterson, F.C.A.I., was presented with the Honorary Degree of Doctor of Laws by the University of Alberta.

T. E. Stephenson, F.C.A.I., was recently appointed Director and Executive Vice-President, Canadian Pratt & Whitney Aircraft Co. Ltd.

Mr. Bowen, A.F.C.A.I., General Manager of Vertol Aircraft Co. (Canada) Ltd., has been elected Vice-President of the firm.

T. A. Harvie, A.F.C.A.I., who recently returned to Canadair Ltd. after a year's leave of absence for a Sloan fellowship at M.I.T., has been appointed Assistant Chief Engineer for Administration.

C. J. Luby, A.F.C.A.I., has been appointed Managing Director of Rotol Ltd. and British Messier Ltd., England.

C. C. Bogart, M.C.A.I., formerly Chief, Air Traffic Control, Air Services Br., Dept. of Transport, has taken up a position as Senior Development Engineer, Franklin Institute Laboratories, Philadelphia.

Dr. J. G. Hall, M.C.A.I., has left the Institute of Aerophysics to join the Aerodynamics Research Dept. at Cornell Aeronautical Laboratories Inc., Buffalo, as Research Aerodynamicist.

G/C W. J. Grant, M.C.A.I., was recently named Senior Technical Staff Officer at Air Defence Command HQ, St. Hubert, P.Q.

S/L J. C. Henry, M.C.A.I., has been posted from Ottawa to the Central Experimental and Proving Establishment, Namao, Alta.

CDR H. J. Hunter, M.C.A.I., has been appointed Commander (Air), HMCS Bonaventure.

K. E. Lewis, M.C.A.I., formerly Design Engineer, Northrop Aircraft Inc., Hawthorne, has now taken up a position as Project Engineer, Topp Industries Inc., Los Angeles.

S. G. Marsh, M.C.A.I., has moved to Baghdad, Iraq, for a two year period where he has taken the position of Engineer in charge of Maintenance, Iraqi Airways.

S/L J. C. Olson, M.C.A.I., has been posted from Cold Lake to M.I.T. Boston, for a two year postgraduate course.

J. Panton, M.C.A.I., has been transferred by Orenda Engines Ltd. from Cold Lake to Malton.

W. H. Riggs, M.C.A.I., formerly Works Manager, has been appointed Vice-President Manufacturing, Avro Aircraft Ltd.

F/O C. A. Wilson, M.C.A.I., has been posted from Cold Lake to Trenton.

S. Elmer, Technical Member, has been transferred from Lockheed Aircraft Corp., Georgia Div., to Lockheed Missile Systems Div., Sunnyvale, Calif., as Design Engineer.

E. G. Enns, Technical Member, has resigned from Muirhead Instruments Ltd., to take up a position as Manager, Commercial & Military Products Div., Stanwyck Coil Products Ltd., Hawkesbury, Ont.

DEATHS

We regret to announce the deaths of the following members:

C. S. Carswell, Technical Member, who was with McColl-Frontenac Oil Co., Vancouver.

W. Duncan, Technical Member, who was Aircraft Inspector, Northwest Industries Ltd., Edmonton.

F/L H. J. Robertson, M.C.A.I., who was with CEPE/RCAF.

J. P. Booth, A.F.C.A.I., who was Chief of Equipment Design, Avro Aircraft Ltd.

E. B. Schaefer, F.C.A.I., who was Chief Engineer (Aircraft), Canadair Ltd.

Dr. E. P. Warner, H.F.C.A.I., who had recently retired from the Presidency of ICAO.

OBITUARIES

Dr. E. P. Warner

Dr. Edward P. Warner, Honorary Fellow of the Canadian Aeronautical Institute since its foundation, died at his home in Connecticut on July 12th, little more than a year after his retirement from the post of President of the International Civil Aviation Organization.

A man of extraordinary talent "Ed", as he was most commonly known among his associates, though ostensibly an engineer and scientist, was dedicated to the cause of democracy and amity among nations; a dedication which he expressed through a selfless devotion to International Civil Aviation in which, as a means of improved contact between peoples, he saw a powerful catalyst in the social and political reactions of these times.

Among his colleagues in the international field he won unparalleled affection, admiration, respect and sometimes astonishment for his seemingly inexhaustible energy, his meticulous sense of duty, his patience and unfailing courtesy in his private as well as in his public relations.

To a man of such fecundity of ideas, such agility of mind, and such foresight, the task of nursing along the slow pedantic democratic processes of international agreement, even in the comparatively concrete field of civil aviation, must have seemed at times to be a frustrating burden, yet he never gave any sign of discouragement and he even increased the tempo of his labours in the last few months of his international career.

Edward Warner was born in Pittsburg in 1894 and was educated at Harvard and MIT. His professional connection with aeronautics began in 1916 when he assisted Professor Klemin of MIT in the design of propellers for prototype aircraft and in the preparation of technical papers for "Aviation" magazine, which had just been founded.

During World War I, Warner was appointed assistant in aeronautical engineering at MIT and with the end of the War he went to NACA, Langley Field, as Chief Physicist. In the fall of 1920 he returned to MIT as an associate professor and during the next five years of teaching he wrote extensively and held several important consultative appointments. For the next three years he served as Assistant Secretary of the Navy for Aeronautics, under the Coolidge administration, and then became editor of "Aviation". In this post and later as a private consultant, he continued to take part in various public activities and, in particular, served as a member of the NACA from 1929 to the end of World War II, as vice-Chairman of the Federal Air Commission in 1934-35, and as a member and vice-chairman of the CAA and CAB from 1938 to 1945.

He was an active member of several technical societies. In 1930 he served as President of the SAE, by whom he was awarded the Wright Brothers medal two years later, for a paper on the relation of load factors to control forces. He was one of the founders of the IAS and took part in the early work of the Aeronautics Division of the ASME. In 1943 he delivered the Wilbur Wright lecture to the RAeS. He was an Honorary Fellow of the RAeS, the IAS and, as stated, the CAI.

In 1944 Dr. Warner visited England to discuss the basis of international air transport after the war. From these discussions arose the Chicago Conference of November, 1944, to which he was a member of the US delegation. During the months that followed he was engaged in the planning of the new organization provided for in the Chicago Convention and was appointed US representative on its first executive body.

At the first meeting of the Assembly of the Provisional International Civil Aviation Organization (PICAO) in 1946 at Montreal, he was elected to the Presidency of the Interim Council and after the establishment of the permanent Organization (ICAO) he was re-elected three times to the Presidency. After a long and honourable career of national service he terminated his professional and social career with eleven years as a servant of internationalism.

A/V/M A. Ferrier

E. B. Schaefer

It is with regret that the many friends and associates of E. B. Schaefer will have learned of his untimely death on the 9th July, 1958.

He was born in New York City in 1907 and obtained his early education in that city. He attended the U.S. Naval Academy and later obtained his Master's Degree in Aeronautical Engineering from New York University. For eight years after his graduation he was an instructor at the Daniel G. Guggenheim School of Aeronautics at New York University before moving to England with Cunliffe-Owen Aircraft Co. He returned to the U.S. in 1940 and joined the Glenn L. Martin Co. as Chief of Fluid Dynamics and Flight Test, a position which he held during the years when the Mars, Mariner, Baltimore, PBM, B-26 and other well-known aircraft were designed or developed. He was affiliated with the Boeing Aircraft Co. for a short time prior to joining Canadair Ltd. in 1949 as Chief Technical Engineer. In 1954 he was appointed Assistant Chief Engineer and in 1957 Chief Engineer–Aircraft, the position he held at the time of his death.

Ev Schaefer brought to Canada not only a wealth of experience and a deep understanding of leadership in aircraft design, but a desire to further the professional interests of aeronautics in this country. He was instrumental in the formation of the Montreal Section of the IAS and was a strong supporter of its amalgamation with the CAI. In addition to being a member of numerous engineering and aeronautical organizations, he was a Fellow of the CAI and an Associate Fellow of the IAS. In 1954-55 he was the Chairman of the Montreal Branch of the CAI and served as a Councillor and its Vice-President in 1956-57.

Ev Schaefer's passing will be recognized as a great loss by all who knew him and our sympathies are extended to his wife and daughter.

R. D. Richmond

ADMISSIONS

At a meeting of the Admissions Committee, held on the 6th June, 1958, the following were admitted to the grades shown.

Associate Fellow

A/C D. S. Blaine, RCAF, Chief Logistics Officer, Air Materiel Command HQ, RCAF Stn. Rockcliffe, Ottawa, Ont.

S. H. G. Connock, Section Head, Instruments and Control Systems Laboratory, Div. of Mechnical Engineering, National Research Council, Montreal Rd., Ottawa 2, Ont.

K. Weinstein (on transfer from Member)

Member

J. A. Bond, Engineer, Canadair Ltd., Montreal, P.Q.: *256 - 8th Ave., St. Eustache, P.Q.*

W. Dobin, Supt. Repair and Overhaul, Pacific Western Airlines, Vancouver Airport, B.C.

A. J. Dunn, Sr. Engineering Planner, Avro Aircraft Ltd., Box 4004, Terminal A, Toronto, Ont.

J. W. Reid (on transfer from Technical Member)

Technical Member

R. H. C. Blatchford, Drawing Officer, Checker, CEPE/RCAF Uplands, Ottawa, Ont.: *45 Marquette Ave., Ottawa 2, Ont.*

J. Charlton, Draftsman, National Research Council, Ottawa, Ont.: *75 Landry St., Apt. 4, Ottawa 2, Ont.*

G. E. Evans, Project Engineer, Airworthiness Section, CEPE/RCAF Stn. Uplands, Ottawa, Ont.

R. O. Sochaski (on transfer from Student)

R. J. St. Cyr (on transfer from Junior Member)

Student

F/C J. H. Bernard, Canadian Services College, Royal Roads, Victoria, B.C.

F/C A. T. Downs, Canadian Services College, Royal Roads, Victoria, B.C.

F/C G. A. Griffith, Canadian Services College, Royal Roads, Victoria, B.C.

F/C H. H. Hunter, Canadian Services College, Royal Roads, Victoria, B.C.

Cadet G. W. Kautz, Canadian Services College, Royal Roads, Victoria, B.C.

F/C R. C. Reid-Bicknell, Canadian Services College, Royal Roads, Victoria, B.C.

F/C F. C. Swain, Canadian Services College, Royal Roads, Victoria, B.C.

F/C E. Voldner, Canadian Services College, Royal Roads, Victoria, B.C.

F/C B. R. Waters, Canadian Services College, Royal Roads, Victoria, B.C.

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At a meeting of the Admissions Committee, held on the 11th June, 1958, the following were admitted to the grades shown.

Associate Fellow

W/C H. Pearce, RCAF (Retd), Coordinator for the National Coordinating Council for the Golden Anniversary of Flight in Canada, Ottawa, Ont.: *315 Daly Ave., Ottawa, Ont.*

Member

D. B. Freeborn, Test Pilot, Engineering Flight Test, Canadair Ltd., Dept. 970, P.O. Box 6087, Montreal, P.Q.

W. D. Gordon, Coordinating Engineer, Avro Aircraft Ltd., Malton, Ont.: *71 Latimer Ave., Toronto 12, Ont.*

A. E. Kennedy, Sr. Sales Engineer, Aviation Dept., Canadian Marconi Co., 2442 Trenton Ave., Montreal 16, P.Q.

W. J. Kenyon, Stress Engineer, Canadair Ltd., Montreal, P.Q.: *1702 Oka Rd., St. Eustache sur le Lac, Deux Montagnes, P.Q.*

H. L. Newman, Service Engineer, Bristol Aero Engines Ltd., Bristol, England: *c/o Bristol Aero Engines (Western) Ltd., Vancouver Airport, B.C.*

S/L J. E. Sammon, RCAF, Sr. Aircraft Maint. Officer, RCAF Stn. Greenwood, N. S.: *3-6th Crescent, RCAF Stn. Greenwood, N.S.*

Technical Member

S. B. Fleming, Test Pilot, Production Flight Test, Canadair Ltd., P.O. Box 6087, Montreal, P.Q.

Miss D. L. Fulton, Technician, Aerodynamics, Canadair Ltd., Montreal, P.Q.: *1565 Decarie Blvd., Apt. 3, St. Laurent, P.Q.*

I. G. Gibson, Liaison Engineer, Canadair Ltd., P.O. Box 6087, Montreal, P.Q.

W. M. James, Defence Production Officer, Aircraft Branch, Dept. of Defence Production, Ottawa, Ont.: *218 Barclay Rd., Ottawa, Ont.*

A. R. Mather, Technician Weights Section, Canadair Ltd., Montreal, P.Q.: *12027 Persillier Blvd., Montreal 12, P.Q.*

LAC L. G. McCaffrey, RCAF, AETech 3(0), RCAF Stn. Trenton, Ont.: *22 Rivers Dr. MP, Trenton, Ont.*

J. P. Rickard, Engineer, Sales and Service, Bristol Aero Engines (Western) Ltd., Vancouver Airport, B.C.

R. D. Sage, Sales Engineer, Canadian Curtiss Wright, Montreal, P.Q.: *2435 Mayfair Ave., Montreal, P.Q.*

Sgt. G. M. Skene, RCAF, Supervisor Instructor, Flight Simulator Maint., No. 2 Technical Training School, RCAF Stn. Camp Borden, Ont.

E. A. Waters, Fuel System Specialist, Lucas-Rotax Ltd., Montreal, P.Q.: *290-67th Ave., L'Abord a Plouffe, P.Q.*

R. B. D. Wright, Technical Assistant, Rolls-Royce of Canada Ltd., Box 1400, Stn. O, Montreal 9, P.Q.

Student

T. C. Routledge, McGill University, Montreal, P.Q.: *400 Campbell St., River Heights, Winnipeg 9, Man.*

Associate

P. J. Hebert, Division Chief, Dept. of Defence Production, Ottawa, Ont.: *515 Westminster Ave., Ottawa, Ont.*

T. L. Orford, Sales Engineer, Canadian Steel Improvement Ltd., Toronto, Ont.: *138 Castlefield Ave., Toronto 12, Ont.*

* * *

At a meeting of the Admissions Committee, held on the 23rd June, 1958, the following were admitted to the grades shown.

Associate Fellow

G. Hake, Quality Control and Inspection Manager, Avro Aircraft Ltd., Box 4004, Terminal A, Toronto, Ont.

C. I. Soucy, Head, Telecommunications Engineering Standards Br., AMC HQ, RCAF Stn. Rockcliffe, Ottawa, Ont.: *2609 Alta Vista Dr., Ottawa 1, Ont.*

Member

J. M. Duggan, Computations Supervisor, Orenda Engines Ltd., Box 4015, Terminal A, Toronto, Ont.

G. H. Fenby, Plant Superintendent, Canadian Pacific Air Lines (Repairs) Ltd., Calgary, Alta.

H. W. Francis, Chief Inspector, Field Aviation Co., Ltd., McCall Field, Calgary, Alta.

C. W. Hawkins (on transfer from Technical Member)

D. A. Jonas, Senior Liaison Engineer, Bristol Aero Engines Ltd., Montreal North, P.Q.: *11831 Filion St., Montreal 9, P.Q.*

C. Kane, Supervisor, Field Service Representatives, Canadair Ltd., Montreal, P.Q.: *3 Hornell Ave., Lakeside Heights, Pointe Claire, P.Q.*

K. A. Katchin, Technician, Trans-Canada Air Lines, Montreal, P.Q.: *2-Third Ave., Dorval, P.Q.*

F/L G. H. Knight, RCAF, Flight Testing, CEPE/RCAF Stn. Uplands, Ottawa, Ont.

E. Pantazoglou, Service Engineer, Canadair Ltd., Montreal, P.Q.: *4715 Plamondon, Apt. 19, Montreal 26, P.Q.*

N. J. J. Sharkey, Charge Hand Inspector, Bristol Aircraft (Western) Ltd., Winnipeg, Man.: *Ste. 44 Thelmo Mansions, 519 Burncll St., Winnipeg 10, Man.*

J. H. Stanley, Foreman, Canadian Pacific Air Lines (Repairs) Ltd., Lincoln Park, Calgary, Alta.

W/C P. Wilkinson, RCAF (Retd.), 835 Island Rd., Oak Bay, Victoria, B.C.

Technical Member

W. Bekker, Component Assembler, De Havilland Aircraft of Canada Ltd., Downsview, Ont.: *3018 Keele St., Downsview, Ont.*

A. Van Den Ham, Crew Chief, Pacific Western Airlines, Vancouver, B.C.: *1855 E. 1st Ave., Vancouver 12, B.C.*

W. F. Weir, Project Engineer, Bristol Aircraft (Western) Ltd., Winnipeg, Man.: *774 Garfield St., Winnipeg 10, Man.*

R. H. Wilson, Chief Draftsman, Aviation Electric Ltd., St. Laurent, P.Q.: *4175 Sir George Simpson St., Lachine, P.Q.*

Junior Member

W. J. Harvey (on transfer from Student)

Student

F/C A. R. Baker, 44 Oxford Rd., Baie d'Urfee, P.Q.

* * *

At a meeting of the Admissions Committee, held on the 24th July, 1958, the following were admitted to the grades shown.

Associate Fellow

L. Doczy (on transfer from Member)

W/C D. W. Goss, RCAF, Assistant for the Arrow Weapon System, RCAF HQ, Ottawa, Ont.: *1376 Westmar Dr., Ottawa 1, Ont.*

F. G. Philpotts (on transfer from Member)

Member

G. Bruce, Prototype Modifications, Canadair Ltd., Montreal, P.Q.: *2295 Madison Ave., Apt. 102, Montreal, P.Q.*

S/L C. E. Elliott, RCAF, Staff Officer Aeronautical Engineering, Maritime Air Command HQ, Halifax, N.S.: *15 Cameron St., Dartmouth, N.S.*

D. A. Holland, Chief Pilot, Canadian Pacific Airlines (Repairs) Ltd., Calgary, Alta.: *4516 Grove Hill Rd., Calgary, Alta.*

J. J. Prairie (on transfer from Technical Member)

E. W. Saunders (on transfer from Technical Member)

Technical Member

J. L. Anderson, Design Draughtsman, Lucas-Rotax Ltd., Toronto, Ont.: *Apt. C-2-8, 5 Delano Pl., Delano Court Apts., Toronto 13, Ont.*

J. H. Barnes, Aeronautical Sales Representative, Sperry Gyroscope Co. of Canada Ltd., Montreal, P.Q.: *556 Inverness Ave., Town of Mount Royal, P.Q.*

M. A. Barry-Smith, Senior Aircraft Planner, Avro Aircraft Ltd., Malton, Ont.: *11 Tayrow Rd., Kipling Heights, Rexdale, Ont.*

O. D. Beck (on transfer from Student)

T. A. Brzustowski (on transfer from Student)

P. Chovansky, Engineer, Trans-Canada Air Lines, Montreal, P.Q.: *739 Godin Ave., Verdun, P.Q.*

F. D. James (on transfer from Junior Member)

E. W. Loveland, (on transfer from Associate)

R. H. McLachlan, Sales Engineer, Orenda Engines Ltd., Malton, Ont.: *3350 Yonge St., Apt. 305, Toronto, Ont.*

F/O W. N. Russell (on transfer from Student)

P. J. B. Wilcox, Planning Engineering Inspector, Dept. 44, Inspection Planning, Bristol Aircraft Ltd., Filton, Bristol, England.

Student

J. W. Baily, Sir George William's College, Montreal, P.Q.: *5509 King George Ave., Cote St. Luc, Montreal, P.Q.*

* * *

At a meeting of the Admissions Committee, held on the 29th July, 1958, the following were admitted to the grades shown.

Associate Fellow

W. R. Stephens, Arrow Weapon System Coordinator, Avro Aircraft Ltd., Box 4004, Terminal A, Toronto, Ont.

Member

D. B. Simmons, Executive Assistant to Managing Director, Maritime Central Airways Ltd., Moncton, N.B.

S/L J. Thomson, RCAF, Technical Officer, Institute of Aviation Medicine, 1107 Avenue Rd., Toronto 12, Ont.

G. G. Trice, Aircraft Planning Engineer, Bristol Aircraft (Western) Ltd., Winnipeg, Man.: *813 Goulding St., Winnipeg 10, Man.*

W. Wallace, Chief Inspector, Phoenix Engineered Products Ltd., 750 Lawrence Ave. W., Toronto, Ont.

S/L G. L. Ward, RCAF, Staff Officer Aero Engineering, Air Defence Command, RCAF Stn. St. Hubert, P.Q.

F/L P. R. W. Webb, RCAF, Project Officer, Directorate of Instrument and Electrical Engineering, RCAF HQ, Ottawa, Ont.: *2426 Huntley Ave., Ottawa, Ont.*

G. E. Weir, Technical Liaison Engineer, Canadair Ltd., Montreal, P.Q.: *2234 Girouard Ave., Montreal 28, P.Q.*

Technical Member

E. H. Collins, Aero Field Service Engineer, Sperry Gyroscope Co. of Canada Ltd., Montreal, P.Q.: *11881 Michel Sarrazin, Apt. 302, Montreal 9, P.Q.*

R. H. Porter, Inspector, Telecommunications, Canadian Pacific Airlines (Repairs) Ltd., Calgary, Alta.: *1728 - 50 Ave. S.W., Calgary, Alta.*

F/L J. G. McKenna, RCAF, Technical Officer, 6 Repair Depot, RCAF Stn. Trenton, Ont.

H. F. Smith, Quality Control Technician, Trans-Canada Air Lines, Montreal, P.Q.: *112 Oakridge Ave., Pointe Claire, P.Q.*

P. M. Smith, Engineer, Canadair Ltd., *Montreal, P.Q.: 469 Stanstead Cresc., Town of Mt. Royal, Montreal 16, P.Q.*

G. Stavroff, Quality Control Inspector, 12 TSU/RCAF, Weston, Ont.: *9 Templar Dr., Toronto 15, Ont.*

F. W. Wood, Engineering Services Supervisor, Avro Aircraft Ltd., Malton, Ont.: *Box 40, Pine Grove P.O., Ont.*

Associate

A. J. Stewart, Electronics Engineer, Canadian Westinghouse Co., Ltd., Government Dept., 1800 Bank St., Ottawa, Ont.

* * *

At a meeting of the Admissions Committee, held on the 12th August, 1958, the following were admitted to the grades shown.

Associate Fellow

F. H. Brame, Chief of Technical Design, Avro Aircraft Ltd., Malton, Ont.: *334 Douglas Ave., Toronto 12, Ont.*

E. D. Poppleton, Asst. Professor of Aeronautical Engineering, Institute of Aerophysics, University of Toronto, Toronto, Ont.

Member

A. J. H. Ashcroft, Designer, Canadian Aviation Electronics Ltd., Montreal, P.Q.: *555 Golf Ave., Beaurepaire, P.Q.*

Lieut. P. Charlton, RCN, Air Engineering Officer, HMCS Shearwater, N.S.: *2 Linden Lea, Apt. 8, Dartmouth, N.S.*

K. H. Fritsch, Chief Development Engineer, Vertol Aircraft Company (Canada) Ltd., Arnprior, Ont.

D. W. Howell, Manager, Fairey Aviation Co. of Canada Ltd. (Western Div.). Pat Bay Airport, Sidney, B.C.

W. S. Little, Jr., Manager, Aviation Dept., Shell Oil Co. of Canada Ltd., P.O. Box 400, Terminal A, Toronto 1, Ont.

M. F. Phillips, Defence Production Officer, Dept. of Defence Production, Electronics Br., Ottawa, Ont.: *328 Frank St., Ottawa 4, Ont.*

K. E. Vallee, Field Service Representative, Canadair Ltd., Montreal, P.Q.: *26 Florette St., Cardinal Heights, P.O. Box 324, Ottawa, Ont.*

Technical Member

J. Erland, Technical Officer, AMC HQ, RCAF Stn. Rockcliffe, Ont.: *538 King Edward Ave., Apt. 3, Ottawa 2, Ont.*

Capt. J. D. Gallagher, Trans-Canada Air Lines, Montreal, P.Q.: *14 Suburban Dr., Streetsville, Ont.*

F/O W. I. Hughes, RCAF (on transfer from Student)

J. J. Nayler, Instructor, Aeronautics Dept., Provincial Institute of Technology and Art, Calgary, Alta.

K. Park, Aircraft Inspector, Canadian Pacific Air Lines (Repairs) Ltd., Lincoln Park, Calgary, Alta.: *1524 - 28th Ave. S.W., Calgary, Alta.*

K. G. Toogood, Design Draftsman, Canadair Ltd., Montreal, P.Q.: *11834 Michel Sarrazin, Cartierville, Montreal, P.Q.*

C. R. Vincent (on transfer from Student)

E. A. Welling, Technical Writer, Canadair Ltd., Montreal, P.Q.: *Box 907, Ste. Rose de Laval, P.Q.*

C. D. Wickes, Engineer, De Havilland Aircraft of Canada Ltd., Downsview, Ont.: *65 Farmbrook Rd., Birnhaven P.O., Ont.*

Junior Member

R. B. Diaper, Student, Provincial Institute of Technology and Art, Calgary, Alta.: *2626 - 30th St. S.W., Calgary, Alta.*

Associate

R. T. D. Graham, Manager, Government Dept., Canadian Westinghouse Co., Ltd., 1800 Bank St., Ottawa, Ont.

SUSTAINING MEMBERS

NEWS

Spartan Air Services Ltd. is equipping some of its helicopters and aircraft with the Varian nuclear precision magnetometer.

The Varian unit is based on an entirely different principle from previous magnetometers. In an earlier version, it has already been successfully used in oil and mining exploration in Africa, South America and the United States. In its new form it will record its results on punched tape instead of continuous strip chart. The tape is then fed into a digital computer on the ground. This replaces the slower method of hand processing of the data in the laboratory.

The computer results, when mapped, indicate the presence of ferrous type minerals, such as iron, nickel and titanium, the presence of basement topography and thickness of overlying sedimentary section for oil exploration, and general information on structural geology.

The U.S. Navy has chosen this instrument for the Vanguard Earth Satellite program to measure the earth's magnetic field in the highly ionized regions of the upper atmosphere. It has also been fired by the U.S. Navy to an altitude of 103 mi in the nose cone of an Aerobee Rocket.

The sensing element of the nuclear magnotometer is essentially a coil of wire immersed in a bottle of water or other liquid containing hydrogen atoms. It uses the principle of nuclear induction—which means that the hydrogen atoms are made to oscillate under the influence of the earth's magnetic field. The frequency of the oscillation is proportional to the earth's magnetic field at any point. This frequency is then recorded on punched tape for convenient computer processing.

Computing Devices of Canada Ltd. are installing the Bendix RDR-1 Weather Radar in the Trans-Canada Air Lines fleet of Viscounts. (Computing Devices are the Canadian representative of the Radio Division of the Bendix Aviation Corp.)

The RDR-1 Weather Radar uses a frequency of 9,375 mcs, corresponding to a wavelength of 3.2 cm. A 22-inch dish-shaped antenna in the nose of the aircraft sends out a narrow beam of radar pulses which are reflected back from clouds or rainfall to form a picture of the weather conditions ahead.

The indicator displays up to 120° on each side of the aircraft heading, at distances up to 150 nautical miles.

Bendix RDR-1 Weather Radar

As an additional feature, the beam can be directed downward to reflect from the ground and therefore can be used to "map" the country ahead. Prominent features, such as bodies of water, show up clearly on the radar screen, enabling the pilot to know his exact position by comparing the radar picture with his maps. This facility is unaffected by weather conditions.

Clouds show up on the radar screen as white patches, frequently with a dark centre. The dark centre indicates regions of high turbulence, which should be avoided. Even though the route ahead may appear to be filled with storm clouds, it is usually possible to plot a path through lanes of relative calm between severe storms by using the weather radar.

Installation in the Viscounts requires little modification beyond a lengthening of the nose to accommodate the radar antenna.

Field Aviation Company Ltd. announces that, effective immediately, they will handle sales, distribution and service of SARAH, a Search and Rescue and Homing device.

SARAH is a complete system of positive location of crashed flying personnel even in conditions of total darkness or fog. The beacon consists of a portable transmitter/receiver with a self-contained power unit, and transmits a continuous homing signal with angular accuracy down to a few feet—also two-way voice communication for directing rescue operations.

Weighing less than four pounds, SARAH is small enough to be part of the pilot's personal equipment, fitting in the pocket of his flying suit, and will transmit a homing signal 66 mi in all directions, allowing an aircraft search path of approximately 130 mi width. The unit consists of a transmitter, batteries and antenna, ruggedly built to withstand a crash, and is completely waterproof.

Bristol Aircraft (Western) Ltd. have obtained RCAF approval of their recently expanded and re-equipped Test and Development Department. The principal functions of the Department are the quality control of plant processes and the development of new manufacturing processes and techniques. Its laboratories are equipped to handle the mechanical and metallographic testing of metals; testing of fusion welders; radiographic inspection of welds, light alloy and other castings; analysis of heat treatment salts, cleaning, plating and anodizing solutions, and chemical film solutions; and testing of anodic, chemical film, and electrodeposited coatings.

Orenda Engines Ltd. will display the Iroquois at the SBAC Show at Farnborough and the USAF Association's Airpower Panorama at Dallas in September. The Iroquois recently completed a series of tests at the NACA Lewis Flight Propulsion Laboratory during which it gave what were then probably the highest dry thrusts (i.e. without afterburner) ever recorded by turbojets on the North American continent. At sustained running well beyond the speed of sound the engine withstood temperatures never before encountered without adversely affecting an engine mechanically. Also, an Orenda-patented relight system gave normal starting after induced flameouts at simulated altitudes up to 60,000 ft, the altitude capability of the tunnel used.

Development engines have completed more than 5,000 hrs of bench running.

In June the last of 3,794 Orenda engines built on Canadian Government contract was completed and, at a special ceremony, handed over to the Hon. Raymond O'Hurley, Minister of Defence Production, and to A/V/M C. L. Annis.

Canadair Ltd., in Montreal, has begun construction of a $1 million environmental laboratory as part of its missile program.

The facility, being built on Montee St. Laurent at Bois Franc Road in suburban St. Laurent, will be a part of Plant No. 4, all of which is being alloted to missile development and production. The

company is already engaged, as coordinating contractor, in the production of Sparrow II air-to-air missiles which are to arm the Air Defence Command of the RCAF in NORAD operations.

The new laboratory will reproduce the severe conditions of extreme temperatures, high altitude, shock, vibration, atmospheric dust and humidity which missiles encounter in service.

Among the initial equipment to be installed, each unit the largest of its type in Canada, will be a centrifuge, 24 ft in diameter, to simulate acceleration; a walk-in temperature, altitude and humidity chamber, reproducing conditions at 120,000 ft altitude and 100° below zero Fahrenheit; and an electro-mechanical vibrator exerting a force of 5,000 lb.

Specially-designed instrumentation will record the results of tests in each case.

The building housing the laboratory and related offices is to be 165 by 90 ft, and 25 ft high.

Railway and Power Engineering Corporation Ltd. announce that the Safe Flight Instrument Corp., one of the companies which they represent, has established a Canadian facility at Malton, Ont. The Malton plant will manufacture, repair and overhaul all the company's products for the Canadian market.

Safe Flight stall warning equipment is now installed in the RCN Trackers and Banshees and in TCA Viscounts; it is being evaluated for the RCAF Argus. In addition, the Trackers and Banshees embody the Safe Flight Speed Central, an instrument developed to facilitate accurate landings of high performance aircraft.

The Company reports that the Lear F-S automatic flight control system, for which Railway & Power Engineering are the Canadian agents, is being supplied for installation in the D.H.C. Caribou.

Canadian Applied Research Ltd. announce the design of an instrument, known as the Hypsometer Statoscope, for air survey work. It will enable the pilot of an aircraft to maintain constant barometric altitude during a photographic mission, supplying him with height deviation information within ± 5 ft.

To obtain the accurate results possible with the Statoscope, the hypsometer principle of pressure detection is used. Pressure changes are detected by measuring the temperature of boiling toluene by suspending a sensing element in the vapour above the toluene. The sensing element is a thermistor, which forms one arm of a bridge circuit. The bridge is balanced by manually-operated switches and a servo-operated potentiometer. A calibrated sensitivity control permits the resultant deviation to be indicated directly in feet at any height within the range of the Statoscope. The toluene and sensing element are enclosed in a cylindrical container called the Hypsometer Head, which is not affected by acceleration and variation in ambient temperature.

After the indicator is set, the statoscope controls are locked in position and the pilot maintains the aircraft at a constant barometric height by referring to the Remote Indicator. Deviation above or below the established barometric datum is recorded on the photograph at the time of exposure and is therefore available as a known factor in the plotting process. A record of drift readings during the survey flight permits the reduction of the barometric surface to a plotting datum by reference to the isobaric gradients.

ATMOSPHERE AND HIGH ALTITUDE CHARTS

In the May issue of the Journal reference was made to two charts made available to members of the Institute by the Garrett Corporation.

Though these charts were accurate so far as their scale permitted, an extended scale of atmospheric pressure and atmosphere specific weight has been deemed desirable if the charts are to be used for engineering purposes. The Corporation has accordingly prepared supplementary charts to the larger scale and copies can be obtained, as before, from The Garrett Manufacturing Corporation of Canada Ltd., Rexdale, Ont.

APPOINTMENT NOTICES

The facilities of the Journal are offered free of charge to individual members of the Institute seeking new positions and to Sustaining Member companies wishing to give notice of positions vacant. Notices will be published for two consecutive months and will thereafter be discontinued, unless their reinstatement is specifically requested. A Box No., to which enquiries may be addressed (c/o The Secretary), will be assigned to each notice submitted by an individual.

The Institute reserves the right to decline any notice considered unsuitable for this service or temporarily to withhold publication if circumstances so demand.

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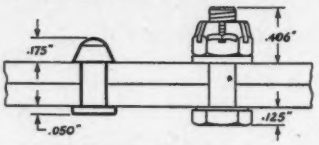

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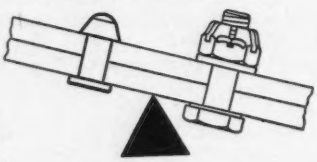

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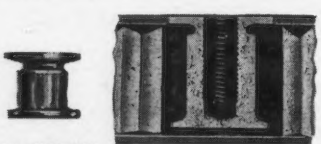

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THEORETICAL DRAG ANALYSTS
Preferably with a masters degree in advance aerodynamics and at least five years' experience on theoretical drag analysis.

OPERATIONS RESEARCH
Requiring a degree in Aeronautical Engineering and two to five years' experience in problems of air defence by manned interceptors and strategy considerations.

ELECTRONICS
With a degree in electronics and five years' experience including at least two years on the design of airborne antennae and interpreting model pattern data. Fire control systems evaluation with knowledge of E.C.M.

SYSTEMS ANALYSTS
With a degree in engineering or physics and mathematics and two to four years' experience in analog computing with a thorough knowledge of servo-mechanism theory.

COMPUTING SPECIALISTS
With experience in the analysis and preparation of mathematical problems for I.B.M. digital computing. At least six months' programming experience essential.

Salaries will be based on qualifications and experience. Offers will be made promptly to qualified applicants.
Benefits include a contributory pension plan and company-paid group life, sickness and accident insurance for you and your dependents.
Apply in the first instance, giving details of your qualifications to:

The Employment Manager,

AVRO AIRCRAFT LIMITED
Box 4004, Terminal "A", Toronto, Ontario.

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Aircraft Propulsion Specialist

The Defence Research Board requires for employment in Ottawa a specialist in aircraft engines and propulsion.

QUALIFICATIONS

A B.Sc. degree in Aeronautical or Mechanical Engineering or Engineering Physics with good academic standing; Experience with propulsion systems generally; Ability to conduct thermodynamic cycle analysis particularly for air breathing engines is essential; Ability to conduct aircraft performance analysis is desirable.

DUTIES

Undertaking special studies or analyses in connection with defence requirements; Evaluation of research and development projects; Technical supervision of extramural research projects; Liaison with research laboratories and the Services on development projects.

Applicants must be Canadian citizens or British subjects.

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Inquiries are invited from interested candidates. Write, outlining briefly your qualifications, to:

Director of Personnel,
Defence Research Board,
Ottawa, Ontario

Please refer to 58 — DRB — 3

Aeronautical Engineers Wanted

Applications for faculty appointments for July 1, 1959, are now being considered; men interested in

(1) material properties and stress analysis,

(2) dynamics, vibrations and design,

(3) fluid mechanics and thermodynamics

should write to the Director, School of Engineering, Carleton University, Ottawa.

MEMBERSHIP OF THE C.A.I.

THE qualifications and annual dues set out in the table below are those presently laid down by the By-laws. The rates of dues shown in brackets are those applicable to members resident outside Canada or the U.S.A.

The annual dues include a non-deductible subscription to the *Canadian Aeronautical Journal.*

An application form appears on the following two pages. Additional forms may be procured from the Secretaries of the Branches or from C.A.I. Headquarters. An applicant does not apply for membership in any particular grade, but each application is considered by the Admissions Committee, who decide the grade suitable to the applicant's qualifications. On admission, the applicant is informed of his grading and the appropriate entrance fees and annual dues.

The entrance fee is $5.00, except in certain special circumstances.

GRADE	SUMMARY OF QUALIFICATIONS	ANNUAL DUES
Student	Undergoing a course of study at an approved school of engineering or technology	$3.00 ($2.00)
Junior Member	Engaged in technical work in aviation	$5.00 ($2.00)
Technical Member	Engaged in science, engineering, research, manufacture or operation, in aeronautics or related fields for 4 years or graduated from an approved school of engineering or science	$8.00 ($5.00)
Member	Engaged in technical work in aeronautics or related fields for 8 years and acquired a recognized standing	$10.00 ($6.00)
Associate	Engaged in aviation, though not qualified for technical grades	$15.00 ($10.00)
Associate Fellow	Engaged in aeronautical science or engineering for 10 years and been in responsible charge or made outstanding contribution	$15.00 ($10.00)
Fellow	Been an Associate Fellow for 1 year and attained distinction in aeronautics	$15.00 ($10.00)

CANADIAN AERONAUTICAL INSTITUTE

APPLICATION FOR MEMBERSHIP

When completed, please forward to:

The Secretary,
Canadian Aeronautical Institute,
801 Commonwealth Building,
77 Metcalfe Street,
Ottawa 4, Ontario, Canada.

.....
Surname

.....
Given Names

.....
Dr., Mr., W/C etc.

Please complete the above in Capitals

Office Record
Date Recd.
Acknowlgd.
Code
Ref.
Elected
Grade

I hereby apply for membership in the Canadian Aeronautical Institute. I certify that all information I have given in this application is correct to the best of my knowledge, and that my references are personally familiar with my aeronautical qualifications.

If elected, I agree to abide by the By-laws and Regulations of the Canadian Aeronautical Institute. Upon termination of my membership, for any reason, I will not use the initials of the Institute after my name and will return, on request, any card, certificate, or insignia of membership.

Signature..... Date.....

(Please type, or write legibly in ink)

Address for mail :
:
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Telephone Nos.: Business:..... Residence:.....

Permanent home address:.....

.....

Date and place of birth:..... Citizenship:.....

Business title, :
Firm name and :
address :

Firm's products, services:.....

Your present duties:.....

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Service decorations, honorary awards, scholarships etc.....

.....

Date and No. of licence, certificate etc., if registered technician or pilot:.....

.....

Other aeronautical qualifications:.....

.....

Current membership in other technical or professional organizations:

Entry Date Grade of Membership Organization

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.....

.....

Technical papers: Title, where presented or published:

.....

.....

.....

ACADEMIC RECORD

Dates	Name and Location of School		Major Subject	Degree or Certificate
	Secondary Technical			
	University Tech. Inst.			
	Other Courses			
	Additional Certificates or Degrees			

OCCUPATIONAL RECORD

Give an explicit summary of your qualifying experience, beginning with current status, then previous positions. Use additional sheet if required.

Dates	Employer's Name, Address, Services	Specific Title, Grade or Position	Nature of Duties, Degree of Responsibility, Supervision Involved

REFERENCES

Name at least four people (of which at least two must be members of the C.A.I., R.Ae.S., I.A.S. or E.I.C.) acquainted with your aeronautical background

Name and Address
1.
2.
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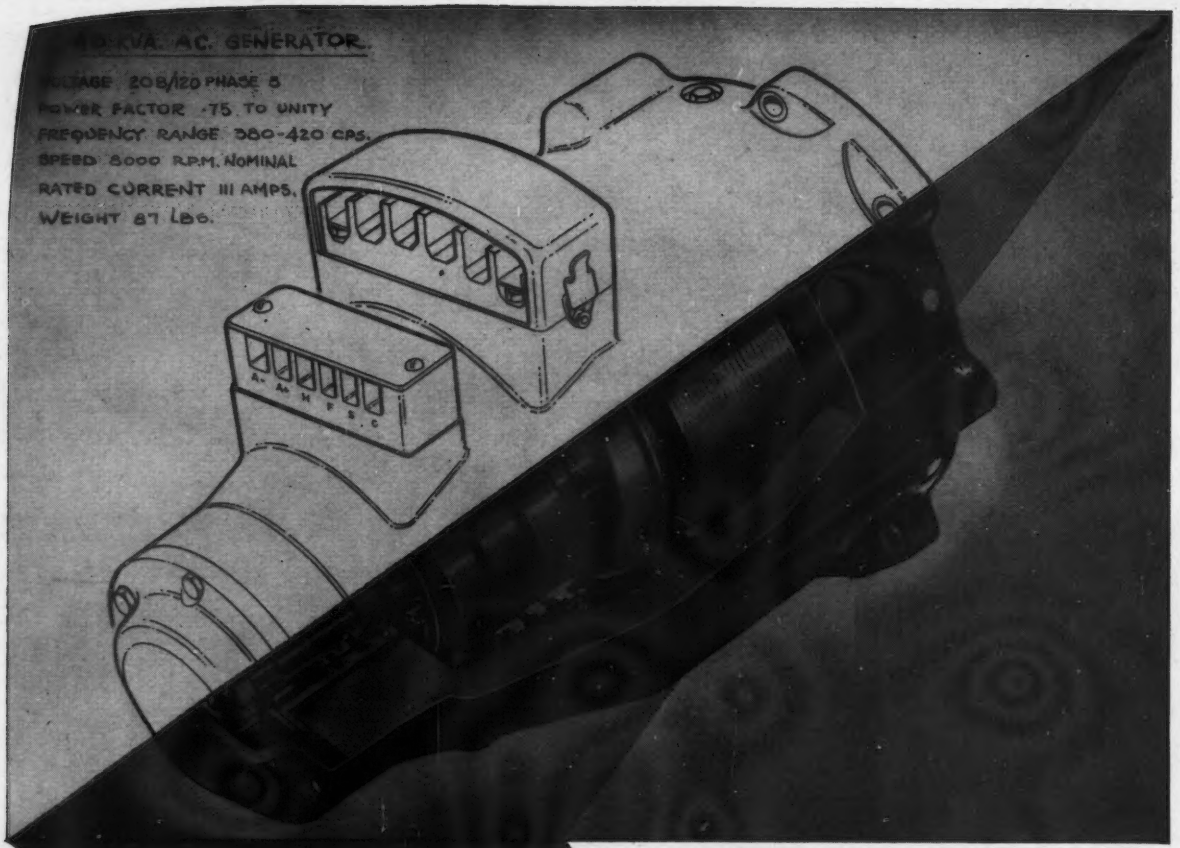
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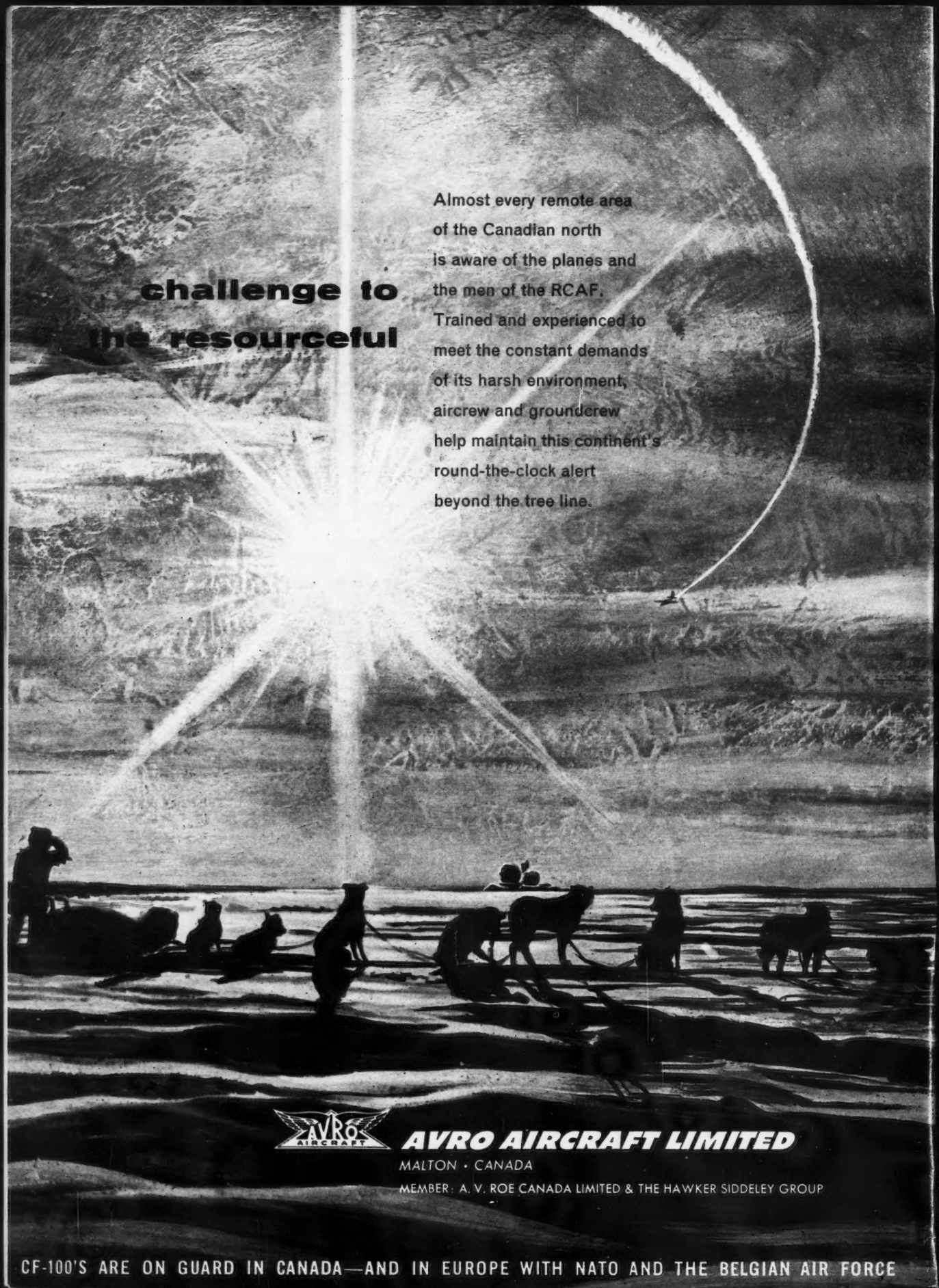
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